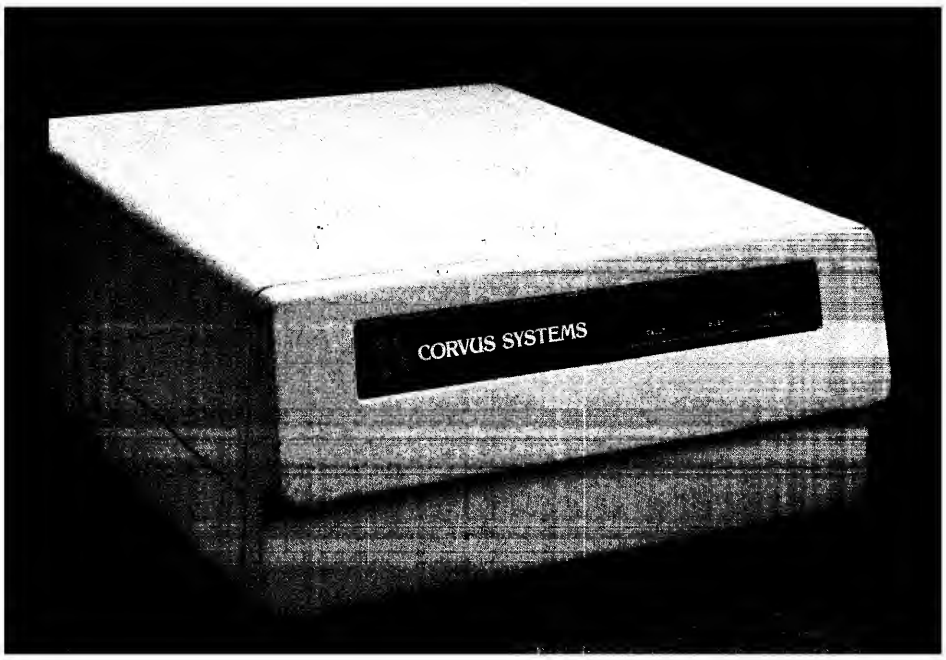
THE CORVUS SERVICE MANUAL



6 Megabyte Drive

CORVUS SYSTEMS

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CORVUS SYSTEMS
B-SERIES 5.25-INCH
6-MEGABYTE
WINCHESTER DISK DRIVE
SERVICE MANUAL

COVERING
REVISION A THROUGH REVISION E

PART NO.: 7100-04703
PUBLICATION NO.: GEN/10.2-01/1.1
RELEASE DATE: JUNE 15, 1983

This document contains three types of notations. These are, in increasing order of importance, *NOTE*, **CAUTION**, and ***WARNING***. The *NOTE* indicates some action to be taken to speed or simplify a procedure. The **CAUTION** indicates that potential damage to the equipment or user data exists, and care should be taken to avoid this. The ***WARNING*** indicates that potential harm or injury to the service technicion or operator exists, and extreme care should be taken to avoid these.

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LIST OF ASSEMBLY AND SCHEMATIC DRAWINGS

SPECIFICATIONS

SPECIFICATIONS

Operational Specifications	**Rev A**	**Rev B-E**
Disks per Drive	2	2
Disk Diameter (in/mm)	5.25/133	5.25/133
Data Surfaces per Drive	4	4
Heads per Surface	1	1
Data Heads	4	4
Number of Data Cylinders/Drive	144	144
Sectors per Track	20	20
Track Density (TPI)	200	200
Bytes per Sector (Formatted)	512	512
Bytes per Track (Formatted)	10,240	10,240
Bytes per Drive (Formatted)	5.9MB	5.9MB
Bit Density, maximum (BPI)	8,800	8,800
Average Latency (ms)	N/A	6.25
Average Access Time (ms)	N/A	125
Maximum Access Time (ms)	N/A	240
Maximum Access Time, single-track (ms)	N/A	3
Data Transfer Rate (Kb/s)	960	960
Recording Format	MFM	MFM
Rotational Speed (RPM)	4,800	4,800
Start Time (s)	30	30
Stop Time (s)	15	15

Physical Dimensions	**Rev A-B**	**Rev C-E**
Height (in/cm)	5.25 / 13.3	5.75 / 14.6
Length (in/cm)	15.0 / 38.1	15.0 / 38.1
Width (in/cm)	14.5 / 36.8	12.0 / 30.5
Weight (lbs/kgs)		

Environmental Requirements	
Operating Temperature (F/C)	50° to 100° / 10° to 37°
Non-Operating Temperature (F/C)	-40° to 140° / -40° to 60°
Operating Relative Humidity (%)	10 to 80
Non-Operating Relative Humidity (%)	10 to 90
Operating Altitude (ft)	-1,000 to +10,000
Operating Vibration (g)	0.1 (5 cps linear increase to 100 cps)
Non-Operating Vibration (g)	1.0 (2 cps linear increase to 100 cps)
Non-Operating Shock (g)	5.0 for 5ms duration

Power Requirements	
Line Voltage, Domestic (VAC)	100-120, 48Hz-62Hz, Single-Phase
Line Voltage, Foreign (VAC)	220-240, 48Hz-62Hz, Single-Phase

	Rev A	**Rev B-E**
Power Consumption (Watts)	125	125
Line fuse (Amperes)		
for 100V-120V	3.0 slow-blow	2.0 slow-blow
for 220V-240V	1.5 slow-blow	1.0 slow-blow

Reliability	
Mean Time Between Failure (MTBF)	10,000+ operational hrs., within above requirements
Maximum Repair Time	Not more than 0.5 hrs.

CHAPTER 1
GENERAL DESCRIPTION

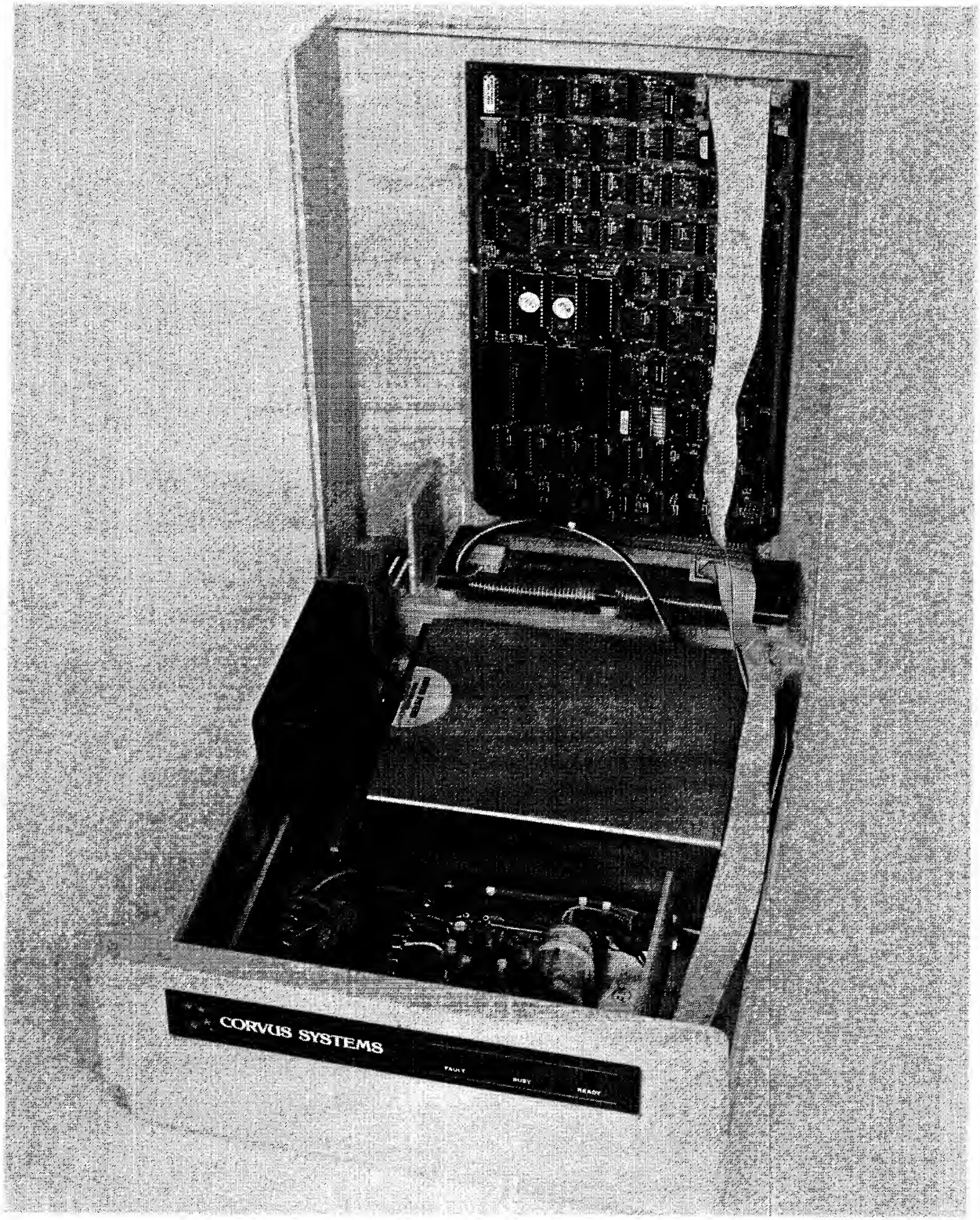

Figure 1-1. B-Series 6-Megabyte Drive (Revisions C-E)

CHAPTER 1
GENERAL DESCRIPTION

1.1 Scope of Chapter

This chapter outlines the purpose of the Corvus B-Series 6-Megabyte Disk Drives. A brief description and layout is included, as is a definition of Winchester technology.

1.2 Introduction

This document contains instructions for maintenance and repair of the Corvus Systems B-Series 6-Megabyte, 5.25-inch disk drive. Repair procedures for all 8-inch drives and 5.25-inch H-Series drives (Model 6, Model 11, and Model 20) are contained in separate service manuals. Repair procedures for networks and other Corvus equipment are covered in other Corvus service publications.

Corvus Disk Drive Product Line

A-Series Drives
- 8-Inch 11-Megabyte drive (Revision A)

B-Series Drives
- 8-Inch 11-Megabyte drive (Revision B)
- 8-Inch 20-Megabyte drive (Revision B)
- 5.25-Inch 6-Megabyte drives (All)

H-Series Drives
- 5.25-Inch 6-Megabyte drives (All)
- 5.25-Inch 12-Megabyte drives (All)
- 5.25-Inch 18-Megabyte drives (All)

Corvus Level I Dealer Service is on a module-replacement basis, and this manual is written to address this policy.

The B-Series 6-Megabyte drive has been manufactured in five revisions (A through E). These five drives were housed in one of two drive cabinets: the metal cabinet, and the high-impact, foam-injection plastic cabinet. Instructions for troubleshooting and repair for all of these drives are detailed in this document.

Also included in this manual is documentation for the Dealer Service Diagnostic Utilities supplied to each Corvus Servicing dealer. These utilities provide for burn-in/reliability testing, adjustment, and troubleshooting of all Corvus Disk Drives.

Installation and operation of the Disk Drive are not covered in detail in this manual. For instructions on installation and operation, see the Corvus "Disk Systems Installation Guide" and Corvus "Disk Systems User Guide."

1.3 Purpose of Equipment

The Corvus disk drive is a high-speed, intelligent mass-storage peripheral disk device designed to provide the host microcomputer with storage of digital information for instant retrieval at the request of the host system. The Corvus disk system consists of the 5.25-inch disk mechanism, a Z-80™ Intelligent Controller, power supply, host interface electronics, and may be ordered with 34-pin interface flatcable and Corvus Utility diskettes.

1.4 Model Identification

The Corvus 6-Megabyte disk drives may be broken down into two functional groups, each having different internal components within the cabinet. The first group consists of the Rev A drive, with the Rev B through Rev E drives making up the second group.

The Rev A and Rev B drives are packaged in the metal cabinet, while the Rev C drive uses a white plastic cabinet, and the Rev D and Rev E drives use a Concept-gray plastic cabinet. The drive type (capacity and revision) and manufacture date may be determined from the serial number tag.

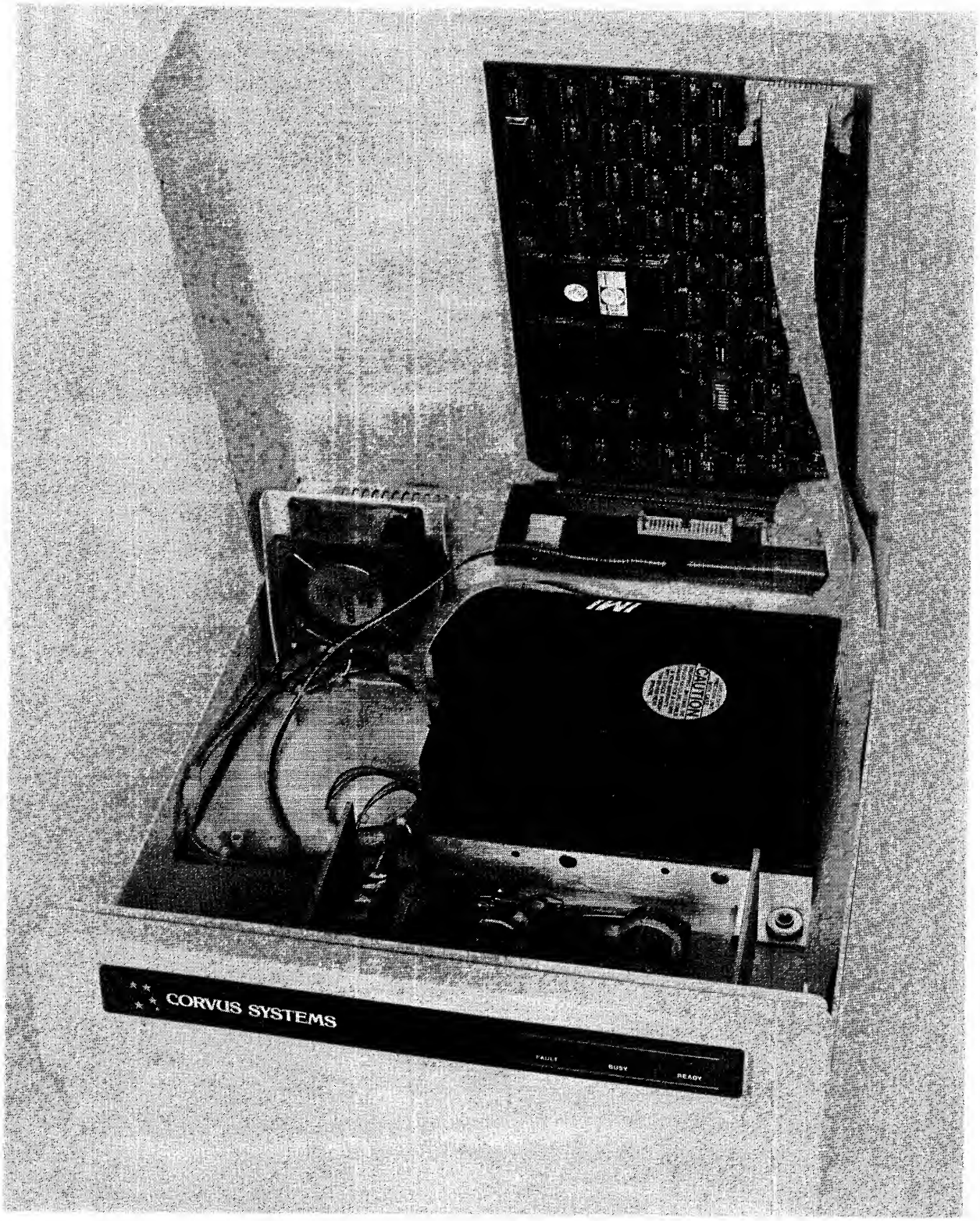

Figure 1-2. B-Series 6-Megabyte Drive (Revision B)

Locate the serial number tag at the rear of the drive basepan. The following is a sample serial number to be found on a Corvus 5.25-inch, 6-Megabyte drive:

142-A350/M

and is decoded below:

14 represents the week of manufacture (week 14)
2 represents the year of manufacture (2 for 1982)
A represents the drive capacity (A=6MB)
350 represents the serial number of that drive
/M represents that this drive was shipped with an internal Mirror installed

Whenever communicating with Corvus in reference to Corvus products, include the serial number of the equipment involved.

1.5 Corvus Disk Systems

The Corvus mass-storage disk system utilizes a sealed 5.25-inch Winchester disk mechanism manufactured by International Memories, Inc. (IMI)™. The drive, with its Intelligent Controller, is designed as a plug-in device, requiring minimal software setup. Interfacing to host computers is via 34-pin flat cable interface. Installation and setup procedures are covered in the corresponding "Disk System User Guide" for the appropriate computer system.

The Rev A drive consists of a 5.25-inch drive mechanism (with Read/Write PCA and Logic PCA), dual power supplies, Z-80 Controller PCA, and cooling fan mounted in the white metal cabinet. The later, Rev B drive consists of a different 5.25-inch drive mechanism (with Read/Write PCA), single power supply, Z-80 Controller PCA, and cooling fan mounted in the white metal cabinet. Rev C, Rev D and Rev E drives share these same components (as the Rev B), mounted in either a white (Rev C) or Concept-gray (Rev D and Rev E) cabinet.

Located in the bottom of the sealed unit is either one Read/Write PCA and one Logic PCA (Rev A drives) or one Read/Write PCA (Rev B through Rev E). These PC Assemblies are not field-serviceable items, and are not available as replacement parts. If the drive mechanism is diagnosed as defective, the entire drive sealed mechanism must be replaced.

The Mirror PCA (when installed) and the Z-80 intelligent Controller PCA are plugged into the two card slots of the backplane, inside the rear of the cabinet.

Although the Rev A and Rev B through Rev E drives are functionally identical (as far as the host microcomputer is concerned), no components are interchangeable, with the exception of the Mirror PCA.

1.5.1 Power Supplies

All 6-Megabyte drives operate from either 110-120VAC or 220-240VAC, 50Hz or 60Hz single-phase power. Rev A drives have two power supplies and the Rev B through Rev E drives have a single power supply. These two different power supply configurations are not interchangeable.

1.5.2 Data Backup

Data backup is accomplished via the Corvus MIRROR™. The Mirror converts the data from digital format to video format which is then stored on video cassette tape, using one of many commercial VCRs. The Corvus Mirror option comes internal to the drive when it is ordered, or added as an external device later. Mirror troubleshooting and repair is covered in the Corvus Mirror Service Manual.

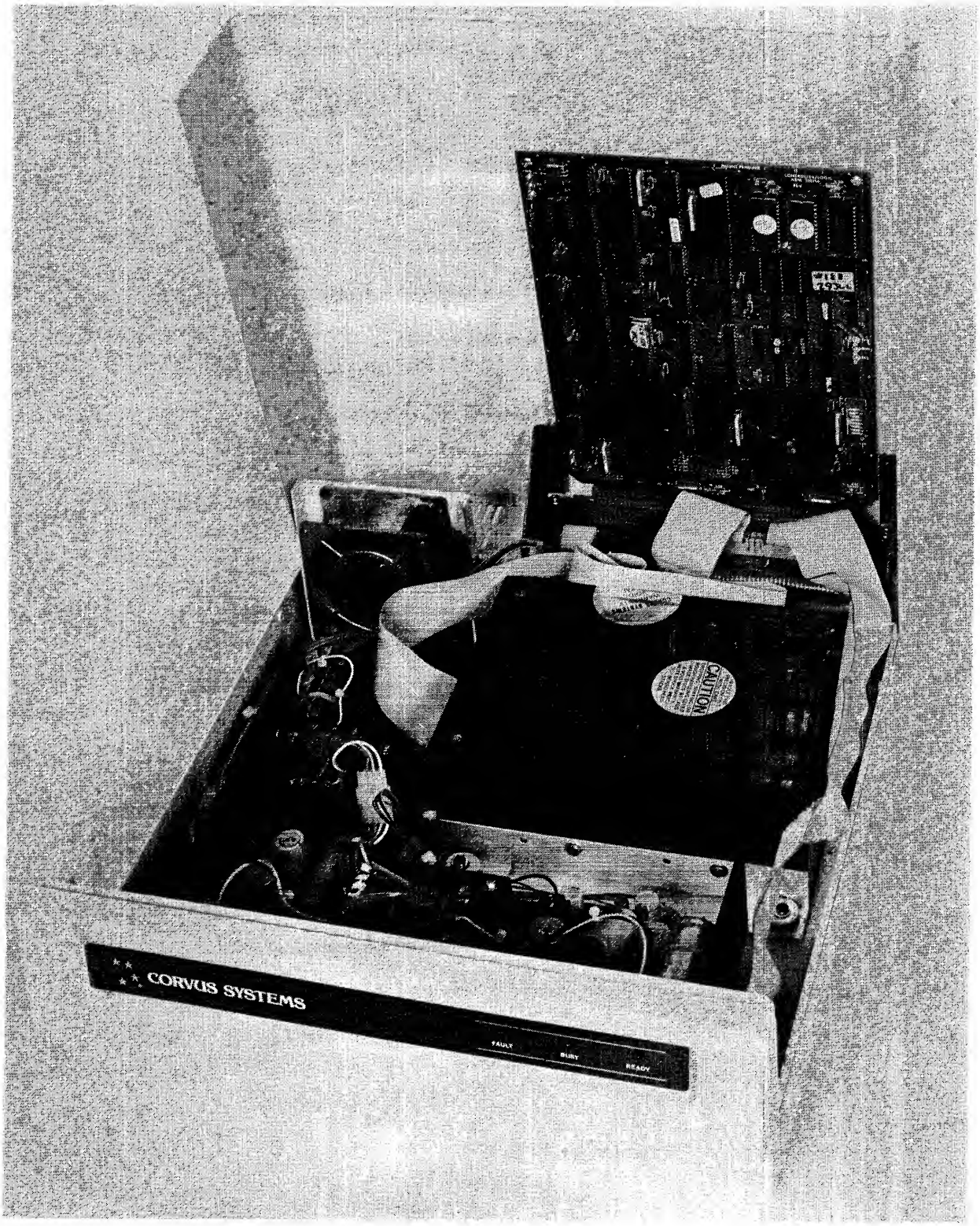

Figure 1-3. B-Series 6-Megabyte Drive (Revision A)

1.6 Winchester Disk Drive

The Corvus disk drive uses the International Memories Inc. (IMI) Winchester disk mechanism. This new generation of disk drive utilizes a sealed environment, and low-load, low-mass, aerodynamically-suspended read/write heads which rest directly on the disk surface after powerdown. It is the contaminant-free environment that allows for reduction in clearance between head and recording media. This results in the heads riding on an 18-microinch air bearing, or air cushion. Since bit density is closely related to head-media clearance and head mass, disk drives utilizing Winchester technology can achieve large storage capacities at a premium of space. An added advantage of the Winchester sealed mechanism is that it requires no regular maintenance.

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™Z-80 is a registered trademark of Zilog, Inc.
™Corvus MIRROR is a registered trademark of Corvus Systems, Inc.

CHAPTER 2
INSTALLATION

CHAPTER 2
INSTALLATION

2.1 Scope of Chapter

This chapter discusses installation of the disk drive hardware as it applies to environmental requirements, to insure proper operation. Installation and operation procedures for the Corvus disk system are outlined in the "Corvus Disk Systems Installation Guide" and "Corvus Disk Systems User Guide."

2.2 Introduction

Upon receipt, each drive should be checked for shipping damage, and tested for proper function. This chapter contains these check-out procedures as well as those for installing single- and multiple-drive systems.

2.3 Receiving a Drive

Any time a drive is received, several checks should be performed before the drive is installed at the customer site. Each Corvus disk drive should be carefully unpacked and checked for shipping damage. External evidence of rough handling may be symptomatic of damage to fragile mechanisms within the drive.

NOTE:

Any damage claims must be reported to the local office of the shipper so an inspection may be made, and a damage report filed. If the damaged equipment is a new product, Corvus Order Processing Department must be contacted for proper return procedures. If the damaged equipment is a recently serviced product being returned under an RMA number (Return Merchandise Authorization number), contact Corvus Customer Service Department for proper return procedures.

The disk drive mechanism in the Corvus Disk System is an extremely sensitive device. Subjecting the drive to a one-g force (one gravity) will be amplified and transmitted to the heads, impacting them onto the platter with a 100-g force. This necessitates very careful handling of the drive mechanism both in shipping and operation.

When a drive is received, check that all chips in the Z-80 Controller PCA are seated well in their sockets. Chips coming loose during shipping account for a large number of failures upon receipt.

1) Remove the screws securing the cabinet cover to the drive basepan (four on Rev A and B drives, two on Rev C, D and E drives), and remove the cover. Be careful not to stress the dc power cable and flatcables connecting the two halves of the drive cabinet.
2) Locate the Mirror PCA (if installed) plugged into the lower of the two card slots of the backplane, and remove it.
3) Locate the Controller PCA installed behind the Mirror PCA, and press firmly on all socketed chips, seating them securely into their sockets.
4) Replace the Mirror PCA.
5) Replace the drive cover and secure it with screws.

2.3.1 Diagnostic Test

When a disk drive is received, its proper function must be verified. The following list of procedures provides a means of accomplishing this.

1) Verify the front bezel switch positions.
2) Verify the Mirror switch positions (on the rear of the drive).
3) Check Controller Firmware VERSION.
4) Check the power supply voltages.
5) Execute the CRC Test.

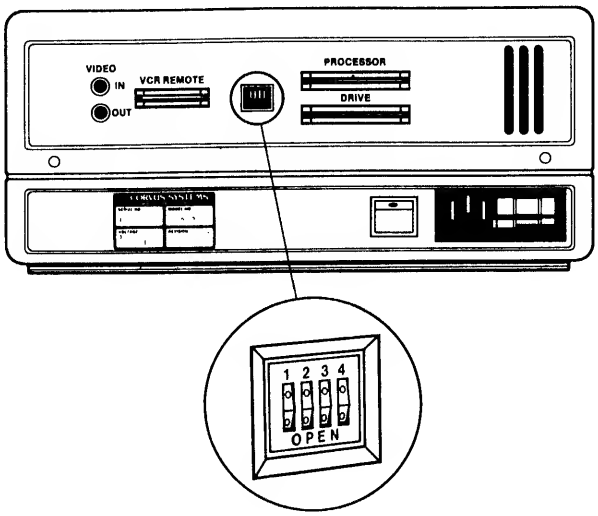
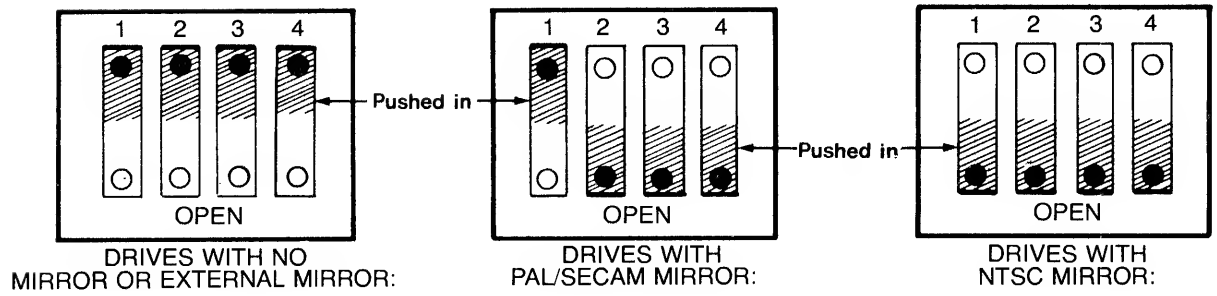


Figure 2-1. Mirror Switch Location



Shading indicates that the switch should be pushed in on that side.

Figure 2-2. Mirror Switch Settings

6) Check the parameters (DRIVE and MUX) and record on paper.

7) Execute the EXERCISE utility.

8) Run the BURN-IN Diagnostic (this is DESTRUCTIVE to data on the drive).

9) Update the Controller Firmware (Drive Diagnostic option UPD) changing the parameter tables when prompted (answer "YES").

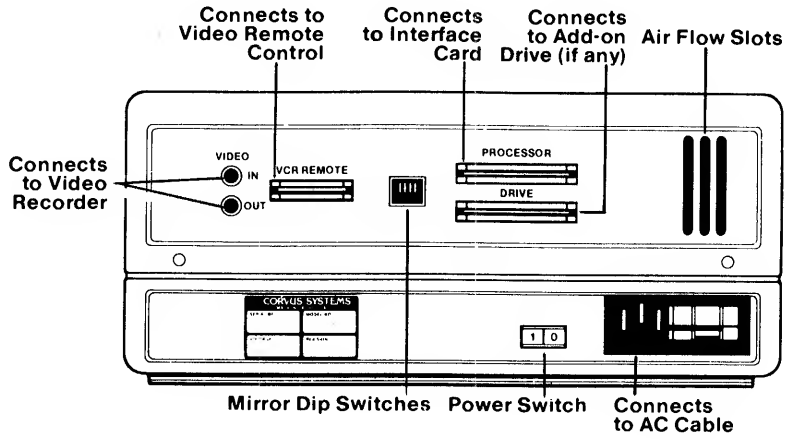


Figure 2-3. Rear Bezel

Any Corvus Disk Drive may be ordered with a Corvus Mirror PCA installed. In the 5.25-inch drive, the Mirror PCA plugs into the Backplane PCA alongside the Controller PCA, inside the cabinet cover. The drive has four DIP switches, located on the rear panel, which MUST be set to correctly reflect the internal Mirror configuration (whether installed or not). If these switches are not set correctly, the drive may not function properly (refer to the chart above for proper switch configuration). Drives using an external, or "Stand-Alone," Mirror should use the "No Mirror Installed" switch combination.

Check the drive power supply voltages and adjust if necessary (refer to Chapter 6, "Adjustments and Maintenance" for details).

Next, thoroughly test the drive, using the Dealer Service Diagnostics (as outlined in Chapter 7 "Diagnostics" of this manual). Execute a CRC-Format Check as well as verify the Drive Parameters (specifically the Spare Track Table and the Virtual Drive Offset Table). If either of these tables display values out of range, use the PARAMETERS diagnostic utility to reset them to their appropriate values.

A new drive may be shipped with up to four tracks spared. There are a total of seven spare tracks available, which leaves a minimum of three (and most likely more) for use in the field. When the Drive Parameters are first checked, the values should be noted, recorded on a label, and attached to the drive for future reference.

In the event that the drive format is disturbed in shipment, it may be necessary to reformat the drive. The FORMAT utility should be used only as a last resort. Using the PARAMETERS diagnostic utility, first try to restore the drive parameters before attempting the FORMAT utility. The FORMAT program will restore default parameters to the drive, and therefore necessitate re-initialization of these parameters with the original values (i.e. previously spared tracks).

Default parameters are:

Spare Track table: no tracks spared

VDO table: Drive 1 = 0

Interleave Spec: all 5.25-inch, B-Series drives = 12

Be sure to check the drive parameters before and after formatting the drive. If the drive has ever had a track spared, the Spare Track table and VDO table may need reconstruction before the data is restored. Knowing which tracks are spared prior to formatting the drive will simplify this procedure. Note on the label, any future tracks spared.

2.4 Environmental Considerations

All electronic equipment needs cooling and the Corvus drive is no exception. When installing, do not "pigeon-hole" the drive. There should be sufficient open air both front and rear. Place the drive on a level, hard surface without foam or carpeting; the air intake slots are on the bottom of the cabinet, and must not be restricted. Do not place a video monitor on top of, or near the Corvus drive. Electromagnetic fields generated by this device may cause drive malfunction.

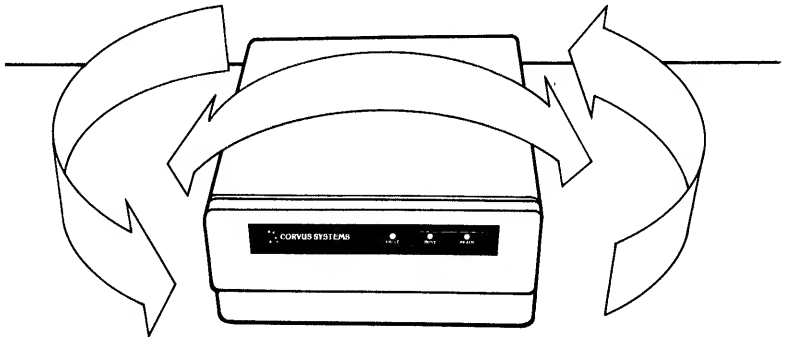


Figure 2-4. Disk Drive Installation (Allow Ample Room Around the Drive Cabinet)

Be sure the proper line voltage has been selected and proper fuse size is installed.

Insure the interface cable is properly connected between the connector on the interface card in the host computer, and the PROCESSOR connector on the rear bezel of the Corvus disk drive cabinet. Be sure the "one" edge (edge with dark stripe) is to the right, when facing the rear of the drive unit.

Check that all four front panel switches are in the correct position. Run your finger along from right to left, under the switches. All switches should be to the left, unless the disk drive is connected to a Corvus Multiplexer Network system, or to a DEC LSI-11™ computer. In this case, the appropriate switches should be set.

Locate the power switch on the rear of the drive, and turn it on. The drive motor will begin to spin, and all LEDs (front bezel Light Emitting Diodes) will come on, and the Busy LED will flash regularly. After approximately thirty seconds, the FAULT LED will go out, and the heads will rezero. LED activity will briefly alternate between READY and BUSY, after which the drive will set the READY signal, and all LED activity will cease, with the READY LED on. The disk drive is now ready for communication with the host system.

2.5 Daisy-Chaining of Disk Drives

A maximum of four physical Corvus disk drives can be interfaced to the host computer. This is accomplished by using a common input/output interface bus, commonly refered to as daisy-chaining. A maximum of 80 megabytes of on-line storage may be achieved by daisy-chaining four Model 20 drives. A special Corvus add-on drive flatcable is available specifically for this purpose. One add-on drive cable is required for each additional disk drive in the system.

All series and versions of disk drives may be daisy-chained together with the exception of the Rev A, 8-inch 11MB disk drive (Rev A drives may be daisy-chained only to other Rev A drives). When connecting H-Series drives in a daisy-chain, use controller firmware version CF18.3 (or newer) on all drives.

Changing the unit-select switches (positions 1-3) on the drive Z-80 Controller PCA for each add-on drive is required when daisy-chaining drives. New drives are shipped with the switches configured as drive 1. Additional drives should be set according to their position in the daisy-chain (2 through 7). Refer to the Corvus "Disk System User Guide" for the appropriate computer system.

For complete installation and initialization procedures, refer to the appropriate Corvus "Disk System Installation Guide" and "Disk System User Guide."

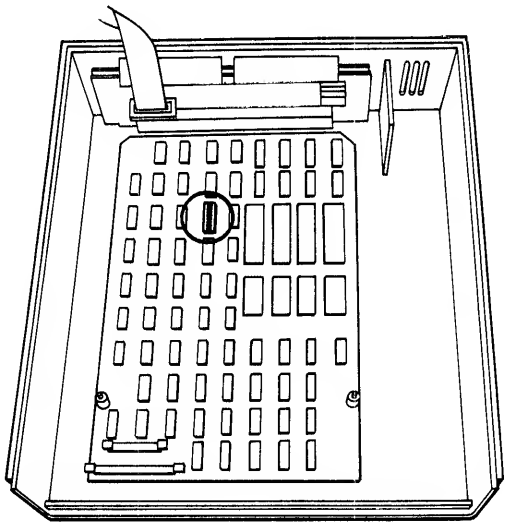


Figure 2-5. Controller Address Switch Location

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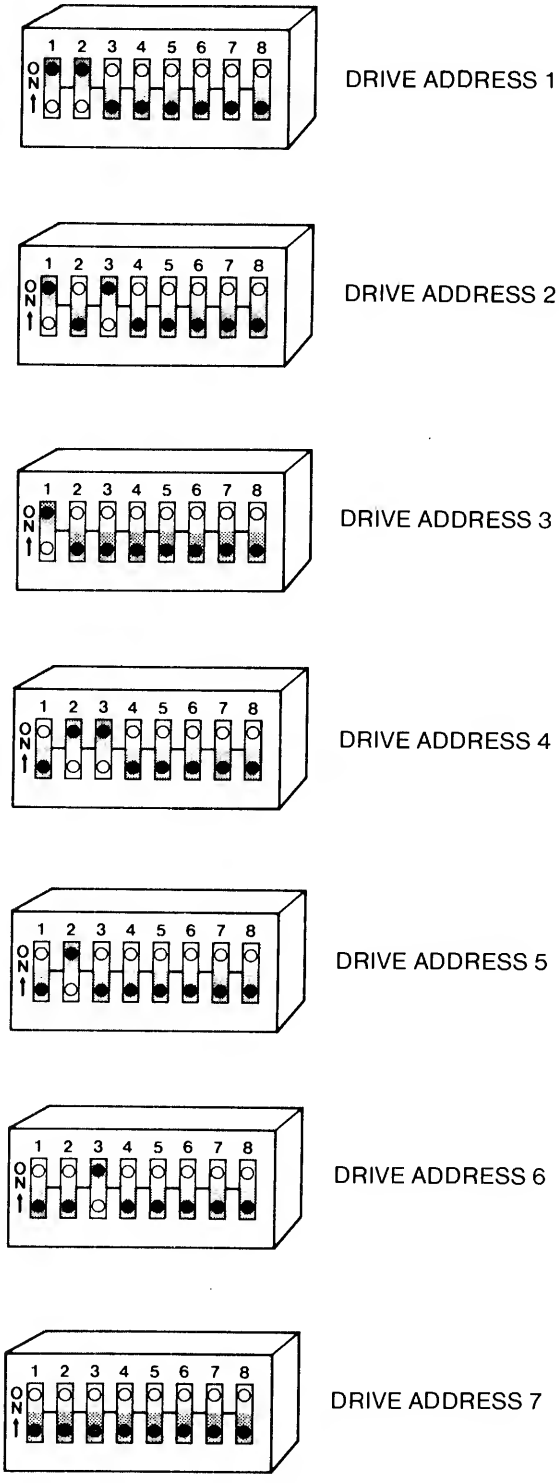

Shading indicates that the switch should be pushed in on that side.

Figure 2-6. Controller Address Switches

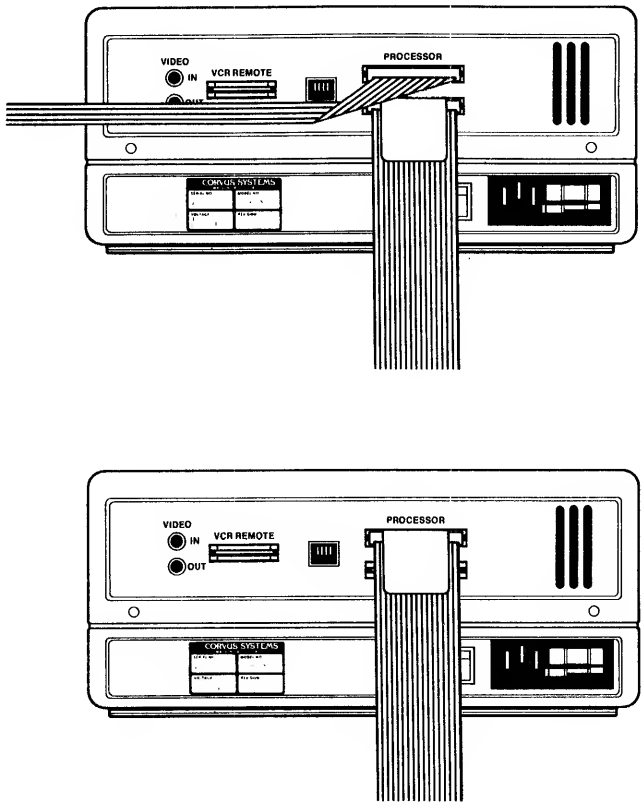

Figure 2-7 Daisy-Chaining of Disk Drives

CHAPTER 3
OPERATION

CHAPTER 3
OPERATION

3.1 Scope of Chapter

This chapter describes operator controls and their use as applies to troubleshooting and repair of the drive. Front bezel control switches and Light Emitting Diodes (LEDs) are described, and their functions detailed. Environmental requirements are discussed, and recommended regular checks for the drive are given.

Operation and initialization instructions are detailed in the Corvus "Disk System User Guide" for the appropriate host operating system.

3.2 Introduction

All Corvus 5.25-inch, 6-Megabyte drives have front bezel indicator lights and function switches. The switches must be set properly to reflect the system configuration in order for the drive to function correctly. Indicator LEDs on the front bezel display the state of the drive, and help in diagnosing the condition of the drive.

3.3 Controls

Operator controls are located on the front bezel of the enclosure. Three LEDs monitor the current state of the drive Controller. Four function switches are located under the LEDs. Rear bezel components consist of fuse and power selection unit (CORCOM), power switch, video connectors, Mirror configuration DIP switches, connectors for host processor, daisy-chained drive, and remote control VCR interface cables.

3.3.1 Front Bezel LEDs

The LEDs are labled READY, BUSY, and FAULT. During the power-up sequence all LEDs are on, and BUSY blinks while the drive motor reaches operating speed. After the drive has completed the power-up sequence, the READY signal will be set, the READY LED will be on, and the BUSY and FAULT LEDs will be off.

During normal operation, the READY LED is active when the drive is ready to receive a command from the host processor. The BUSY LED is active when the drive is currently executing a command received from the host processor. The FAULT LED is active when command execution has been interrupted due to the occurrence of an error. The FAULT LED is an indicator of drive malfunction or operational error, although some software may cause this LED to light during normal operation. The FAULT LED function is accompanied by an error code displayed on the computer screen.

3.3.2 Front Bezel Switches

The function switches are located below the LEDs on the front bezel. These are (from left to right) LSI, MUX, FORMAT, RESET. During normal operation, in a single-user system without an LSI-11 computer, all switches should be set to the left.

All switches except for the RESET switch are software switches. The Controller ROM routine polls the switches to ascertain system configuration. Only the RESET switch directly affects the hardware.

Located farthest to the left, the LSI switch is a two-position switch; the OFF (left) position is the normal position, the ON (right) position is for use with a DEC System LSI-11. At power-on time, the controller polls this switch. If a DEC LSI-11 computer is attached, it loads the DEC RL01™ and RL02™ disk drive emulation routines from the Controller Firmware area into controller RAM.

The next switch, the MUX switch, is also a two-position switch; the OFF (left) position is the single-user position, the ON (right) position is for use with the Corvus Multiplexer Network™. At power-on time, the controller polls this switch to determine if a Multiplexer is attached. If a Multiplexer is connected, it then loads the Multiplexer polling routine from the Controller Firmware area into controller RAM.

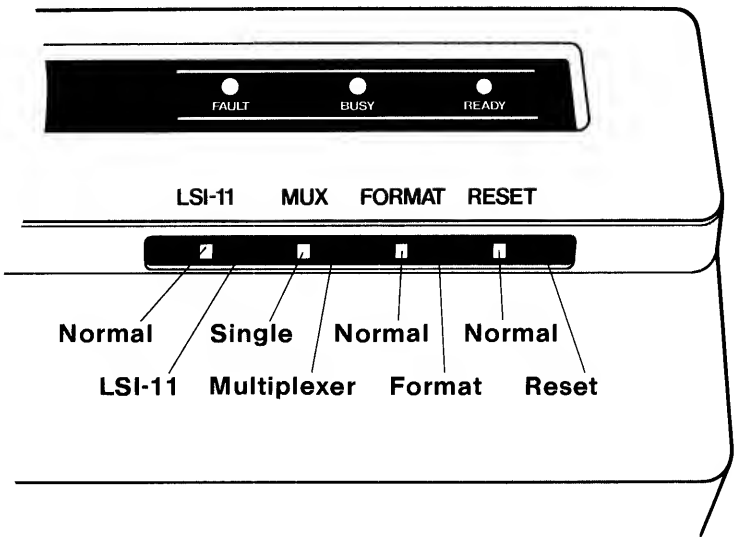

Figure 3-1. Front Bezel Configuration Switches

The FORMAT switch is a two-position switch; left position is OFF (normal), right position is ON. This switch serves two functions. First, when the drive is turned on, the controller checks all front bezel switches. If the FORMAT switch is ON (right) at this time, the drive will come READY if the ROM-based self-test completes successfully. If, however, this switch is OFF, the controller reads the Controller Firmware from cylinders 0 and 1 into the on-board controller RAM. If this procedure is successful, the controller sets the READY signal, the READY LED is lit, and the BUSY and FAULT LEDs are extinguished. The drive is now ready to accept a command from the host system. Secondly, the FORMAT switch must be on for the diagnostic program F)ORMAT to execute (see chapter 7 "DIAGNOSTICS"). In this mode the switch acts only as a hardware safety switch. No one may execute the F)ORMAT program without having physical access to the drive. The switch being turned ON alone will not format the drive. Only the combination of the format software and the FORMAT switch will allow one to format the drive. If this switch is ON during normal operations, communication between the drive and the host system may be impaired.

Located farthest to the right, the RESET switch is a spring loaded, momentary-contact toggle switch. Toggling this switch initiates a reset signal which resets the intelligent controller in the drive to its original power-on state: the heads rezero and the disk Controller Firmware is again loaded from the disk into the controller RAM. The drive is then ready to accept another command from the host processor.

3.4 Power-On Sequence

No specific sequence need be followed when powering on the Corvus Disk System, with one exception. If the Corvus disk drive is used with an OMNINET™ local network, power on the Disk Server first. Next power on the disk drive, then the host computer. This procedure supersedes all other procedures that may be found in previous Corvus publications.

3.5 Environmental Requirements

All working environments contain possible hinderances to proper operation of electronic equipment. The following are some environmental problems and their solutions.

3.5.1 Static Electricity

Static voltages of thousands of volts can be generated in most office environments. If a system shows irregularities whenever an operator comes in contact with the host computer, network or peripheral equipment, supporting table or surface, static should be suspect.

Static is most easily generated in a cool and dry enviromnent, usually associated with cold weather. Since increased humidity helps prevent static electricity buildup, some type of humidifying device can be helpful. Ideal relative humidity is 70 percent to 75 percent.

3.5.2 Line Noise

Electrical noise on the power line is a major cause of inconsistent equipment operation. Voltage spikes, "brownouts" and dropouts as well as low line voltage are just some of the common causes of drive malfunction.

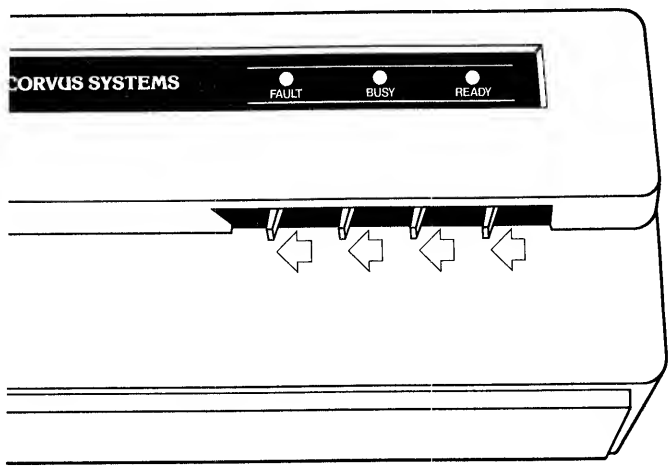

Figure 3-2. Single-User Front Bezel Switch Positions

Located in the CORCOM power selection unit is a line filter capable of handling minor electrical noise on the power line. Also, the power supply is capable of handling dropouts of up to three complete power cycles.

If power is suspect, the problem may lie in poor continuity of the building wiring, noisy or high power-consumption devices on the same circuit, or poor external supply to the building. Power can be improved by including a constant voltage regulator or isolation transformer in the power circuit. The constant voltage regulator will help minimize the effect of line voltage fluctuations on the Corvus Drive, while the isolation transformer will be effective in protecting the Corvus Drive from line noise caused by other high-load electrical equipment such as photocopy machines, heating and cooling equipment, elevators, etc. To lessen the impact of frequent power interruption, the use of an uninterrupted power supply (UPS) is recommended.

3.5.3 Temperature

Although in most environments, the disk drive needs no actual warm-up time, there are temperature limits that the drive must operate within (see specification chart at beginning of this manual). The temperature-change maximum for the Corvus disk is 15 degrees Fahrenheit per hour.

3.6 Periodic Maintenance

Inherent in the design of the Winchester technology disk devices, is the freedom from the need for regular preventive maintenance. The sealed disk mechanism of the Corvus disk drive requires no maintenance, and contains no field-serviceable components.

CAUTION:

Since contamination of the atmosphere in the mechanism necessitates replacement of the unit, removing the cover to the sealed mechanism voids all warranties.

3.6.1 Regular Checks

Each time the drive cabinet is opened, check the power supply voltages to verify that they are within specified tolerances (refer to chapter 6 for adjustment procedures). Power supply voltages will change with time, and should be checked periodically.

Due to slight oxidation buildup on cable connectors and IC pins, reseating flat cable and power connectors and chips periodically will also help insure reliability.

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CHAPTER 4
DRIVE DESCRIPTION

CHAPTER 4
DRIVE DESCRIPTION

4.1 Scope of Chapter

This chapter provides a description of the components of the Corvus B-Series 5.25-inch, 6-Megabyte Disk Drive and their interactions. Some terms are defined to help provide a foundation for the descriptions.

4.2 Introduction

The Corvus 6-Megabyte Drive is divided into two basic revision groups:

1) Rev A Drive
2) Rev B through Rev E Drives

Each of these is further divided into three functional groups; Power Supply, Disk Sealed Mechanism, and Controller Electronics. These are defined as modules, and are field-replaceable as such.

As mentioned elsewhere in this manual, five versions of the Corvus 5.25-inch, 6-Megabyte drive were manufactured. A drive may be identified by the revision noted on the serial number tag located on the rear bezel.

4.3 Drive Revisions

All Revisions have:

— Disk Sealed Mechanism
— Power Supply or Supplies
— Backplane PCA
— Controller PCA
— Mirror PCA (if installed)
— Paddleboard PCA
— Drive Cabinet

4.3.1 Revision A Drive

The Rev A drive was shipped only in a metal drive cabinet, which contains the dual power supplies, as well as the early version sealed mechanism. This early disk mechanism can be identified by the two PCAs located on the underside of the sealed unit. The drive sealed mechanism, as well as the two PCAs underneath it, is unique to the Rev A and may not be interchanged with units of another revision.

The Revision A drive uses two power supplies. All other Corvus drives use single power supplies. Neither of the Rev A's power supplies is interchangeable with supplies of other revision Corvus drives. The dc power cable, originating at the power supplies, terminates with three power connectors which connect to the two pc boards underneath the drive mechanism, and the one on the Backplane PCA.

The Backplane PCA is attached to the drive cover with brackets. The Backplane has two card slots which accept the Controller PCA (nearest the cover) and the Mirror PCA (when installed). While physically similar, the Rev A Backplane is not interchangeable with other revisions of the 6-Megabyte drive.

The Controller PCA is located in the uppermost slot of the Backplane PCA. Although this circuit board is physically identical to the Corvus 8-inch, 11- and 20-Megabyte drive Controller PCA, it is not electrically compatible, and therefore not interchangeable. The Rev A Controller is also not interchangeable with the Rev B through Rev E 5.25-inch drives.

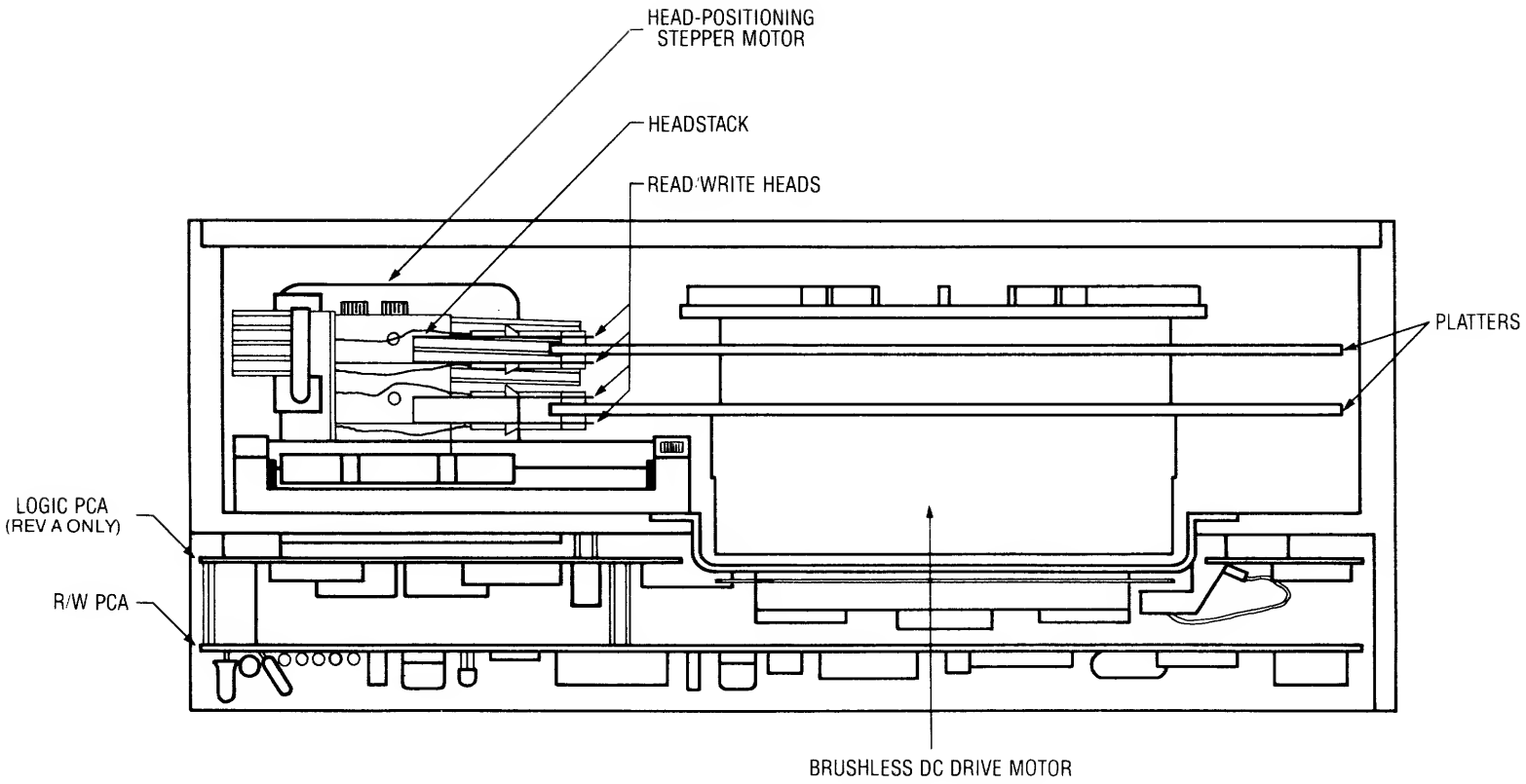

Figure 4-1. Disk Drive Sealed Mechanism

The Mirror PCA is located in the lower slot (farthest from the cover) of the Backplane PCA. The 5.25-inch Mirror is compatible with all versions of Corvus 5.25-inch disk drives. All Corvus 6-Megabyte drives have four DIP switches on the rear of the drive which MUST be configured to reflect the internal configuration of the Mirror PCA. If the drive has no Mirror PCA installed, the switches must be selected to reflect this configuration. Likewise, if a Mirror PCA is installed, the switches must be reset to reflect this change. See the table below for the proper switch settings.

Mirror Switch Settings

	Switch 1	Switch 2	Switch 3	Switch 4
External Mirror or No Mirror	Closed	Closed	Closed	Closed
PAL/SWCAM Mirror	Closed	Open	Open	Open
NTSC Mirror	Open	Open	Open	Open

The front bezel Paddleboard PCA contains the four function switches: FORMAT, RESET, MUX, and LSI-11, as well as three LEDs: FAULT, BUSY, and READY (see chapter 2 "Operation" for a full description of these components). The Paddleboard used on all 5.25-inch drives and on most 8-inch drives is compatible, and therefore interchangeable.

4.3.2 Revision B Drive

The Rev B drive retained the metal cabinet of the Rev A drive, but acquired all new internal components. The new drive sealed mechanism can be identified by the one Read/Write PCA located underneath the drive unit. This mechanism with its one Read/Write PCA is shared with the Rev B through Rev E 5.25-inch, 6-Megabyte drives, and are completely interchangeable.

The Rev B power supply is a single unit, the same one used in the later drive revisions supplying +12V and +5V, and is therefore completely compatible with the Rev C through Rev E drives. The Rev B power supply is not compatible with the Rev A model, and cannot be interchanged.

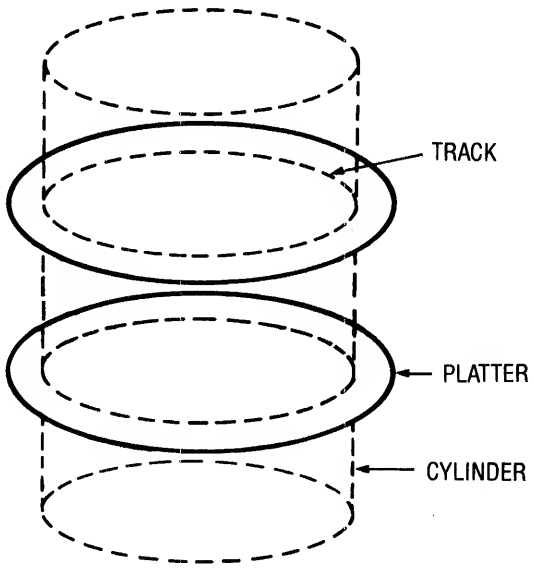

Figure 4-2. Data Configuration

The Rev B Backplane PCA is attached to the drive cover via standoffs. The Backplane PCA has two card slots which accept the Mirror PCA (when installed) and the Controller PCA (nearest the cover). The Rev B Backplane is the same one used in the Rev C through Rev E, B-Series 6MB drives and is interchangeable between these three later drive revisions. The Rev B Backplane PCA is not compatible with the Revision A drive and may not be interchanged.

The Controller PCA is identical to the Rev C through Rev E, B-Series 6MB drives and is interchangeable between these four drive revisions. The Rev B Controller PCA is not compatible with the Rev A drive, and is not interchangeable.

The Mirror PCA used with 5.25-inch drives is interchangeable between all H-Series and B-Series drives of this size (5.25-inch).

The front bezel Paddleboard PCA is the same PCA used in all revisions of the 5.25-inch drive and most versions of the 8-inch drives, and is interchangeable between these drives.

4.3.3 Revision C, D, and E Drives

With the exception of the cabinet, the Revision C drive is identical to the Revision B drive. The Rev C drive uses a white plastic cabinet, while the Rev D and Rev E drives use a gray plastic cabinet. Both drives contain the same components as the Revision B drive. Slight differences in mounting hardware may exist with the plastic cabinet, but all internal components of the Rev C, D, and E drives are identical to the Rev B drive. (For details on the components of the Rev C, D, and E drives, refer to the previous descriptions for the Rev B drive.)

4.4 General Description

The recording media of the Corvus 5.25-inch Winchester disk drives consists of an nickel-oxide coating on aluminum disks called platters. There are two 5.25-inch platters in all B-Series 6-Megabyte drives, all four surfaces being utilized for data storage. One head rides above each surface on an 18-microinch air bearing (air cushion).

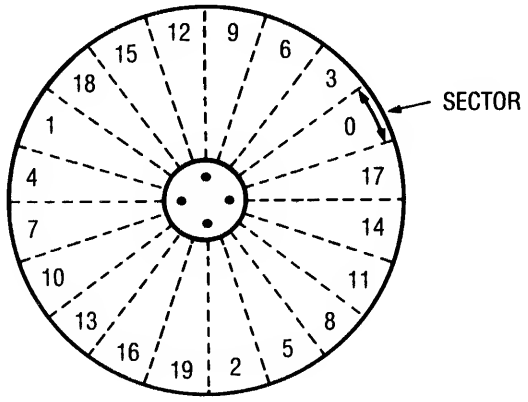

Figure 4-3. Sector Interleaving

Data is stored magnetically on circular tracks, which are configured as concentric circles on each platter. Each track is further divided radially into 20 sectors, each sector containing one 512-byte block of user data. The term track refers to a single head surface of a cylinder, each cylinder consisting of one track from each surface (four total), in common vertical alignment. There are 144 cylinders on the 5.25-inch, B-Series 6-Megabyte drive, with cylinder zero located farthest from the platter center.

A block is the smallest addressable quantity of data within the drive. Internally, each block consists of 512 bytes of data. Externally, the drive handles data in sectors as defined by the host computer.

Typically, each host operating system defines a sector as 128 bytes, 256 bytes or 512 bytes. The Corvus interface software uses the appropriate read and write commands (one each for writing and reading 128, 256 or 512 bytes) depending on the type of operating system.

This does not cause a conflict, since the drive simply stores 1,2 or 4 host-defined sectors for each block. Read and write commands of less than 512 bytes are transparent to the host system, due to the Intelligent Controller's ability to handle data blocking internally.

4.4.1 Disk Sealed Mechanism

The Corvus mass-storage disk mechanism uses a combination of both new Winchester technology and traditional disk design.

The 5.25-inch platters revolve on a common spindle, driven by a brushless dc motor at a speed of 4800 RPM. Motor speed is monitored and automatically adjusted at the motor, and is independent of line frequency. A sector disk is located at the lower end of the spindle, and is monitored by an LED and phototransistor which provide sector pulses to the drive electronics. A solenoid brake contacts the motor hub after power-off.

Each head glides 18-microinches (18 millionths of an inch) from the platter surface on an air bearing, or air cushion. A particle of smoke or dust, or a human hair could easily play havoc with with these critical tolerances, and cause catastrophic failure of the disk device. The seal on the drive cover keeps the internal atmosphere contaminant-free. BREAKING THIS SEAL FOR ANY REASON, VOIDS ALL WARRANTIES.

The heads are held by flexure arms, attached to a common head stack casting which moves on precision bearings and stainless steel rails. Positioning of the heads over the appropriate cylinder is done by a three-phase stepper motor, connected to the head stack by a stainless steel band. Seeking to a specific cylinder is accomplished by stepping the motor through three phases for each cylinder. Simply reversing the sequence of these motor phases will result in reversing the direction.

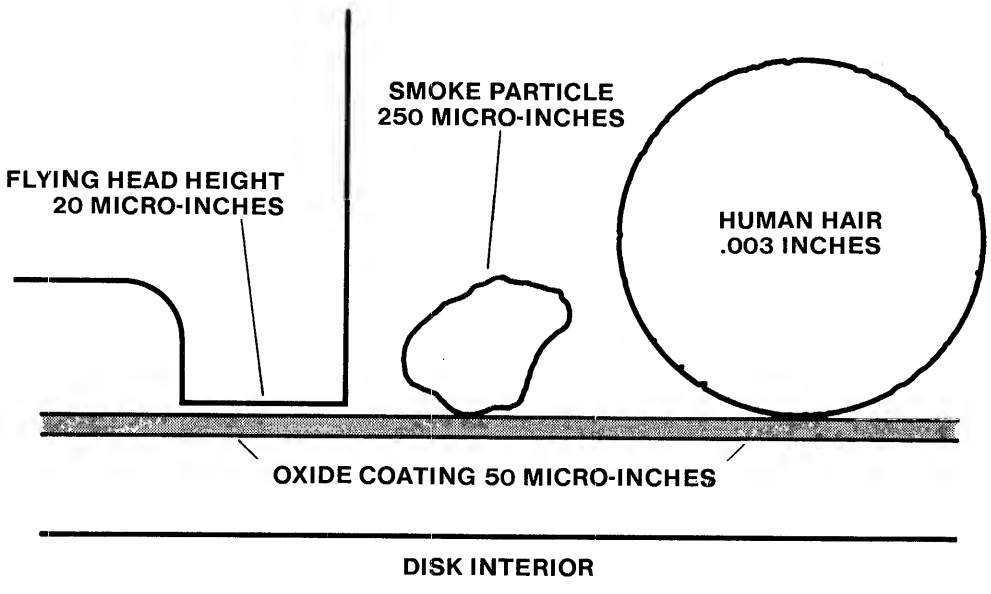

Figure 4-4. Disk Drive Contaminants

Mounted beneath the drive mechanism is either one PCA (Revision B through Revision E drives) or two PCAs (Revision A drives). These are the Logic PCA, and the Logic PCA and Read/Write PCA, respectively. Since these are considered integral components of the sealed mechanism, individual replacements for these PCAs are not available. If either of these PCAs are diagnosed as defective, the entire disk mechanism must be replaced.

4.4.2 Power Supply

Every Corvus 6-Megabyte Drive comes with a power supply(ies) to provide all voltages required by the drive mechanism and drive electronics. The two drive groups (Rev A, and Rev B through Rev E) have different drive mechanisms which require different voltages. The Rev A drive mechanism requires +12V, -12V, +5V, and -5V, while the Rev B through Rev E drive mechanism requires only +12V and +5V.

4.4.2.1 CP134 (Rev A)

The CP134 is a black, open-chassis power supply (the larger of the two Rev A power supplies), which provides the +12V, -12V and -5V voltages required by the drive. All three voltages are adjustable. The CP134 is mounted in the metal drive cabinet, along with the HB5 power supply.

4.4.2.2 HB5 (Rev A)

The HB5 is the smaller of the two power supplies mounted in the Rev A metal cabinet, and provides +5V required by the drive. The +5V is adjustable.

4.4.2.3 CP417 (Rev B through Rev E)

The CP417 is the only power supply required by the Rev B through Rev E 6-Megabyte Drives. Providing the +12V and +5V required by the drive components, the CP417 is used in the metal cabinet (Rev B) and the plastic cabinet (Rev C, D, and E) drives.

4.4.3 dc Power Cables

All power supplies connect to a dc power cable which then connects to the disk mechanism and the drive Backplane PCA. All dc power cables attach to solder terminals on the power supply PCB.

4.4.3.1 Rev A dc Cables

The Rev A power cable connects the two power supplies with the two PCAs on the underside of the drive mechanism, as well as the Backplane PCA connector. The power connectors for these PCAs are paralleled, and are interchangeable. These are polarized, to assist proper connection.

4.4.3.2 Rev B through Rev E dc Cables

In later drive revisions, the power supply cable connects the single power supply to the single PCA on the underside of the disk mechanism, and to the Backplane PCA. The power connectors are also polarized, to assist proper connection.

4.5 Controller Firmware

Corvus reserves the first two cylinders of the drive for system information. This is referred to as Controller Firmware, and is not accessible to the host operating system. This firmware contains programming and system parameters needed by the Z-80 drive controller which is loaded into the disk drive RAM when the drive is powered on or the RESET switch is toggled. The MIRROR driver routines, spare track table, Multiplexer parameters and Semaphore status flags are a few examples of Controller Firmware. Identical copies of Firmware reside in each of the two cylinders. The rest of the disk area is available to the host system for data storage, the configuration of which depends upon the type of host operating system.

4.6 Data Storage

Data storage arrangement is by concentric tracks aligned in vertical cylinders. Each track is sectioned into 20 sectors, each sector has a capacity of 512 eight-bit bytes. Logical sectors are numbered by using an interleaving specification of twelve (for the B-Series, 5.25-inch drives), except for use with the DEC LSI-11 which uses an interleaving specification of six (B-Series drives only).

All four surfaces are used for data storage. All four heads transfer digital information to and from the platters.

Contained in the head stack is the microchip. This head select and driver microcircuitry is responsible for selecting which head is being used, and transmitting the signal to the drive electronics for further amplification.

4.7 Transportation Considerations

The Corvus B-Series 6-Megabyte, 5.25-inch Disk Drive has no locking device for the head carriage. This requires one careful consideration before transporting the drive; after powering off the drive, wait for the motor to stop spinning before moving the drive.

When the drive is powered off, the heads will not move. This means that heads rest on the data area of the media when the drive is shipped. If, when the drive is transported, it is subjected to rough handling, the heads will impact the disk surface in a critical area, possibly causing damage to the media. Gentle handling of the drive is essential for the drive to survive shipping.

4.8 Theory of Operation

The Revision A, and Revisions B through E 6-Megabyte, 5.25-inch drives are, though physically dissimilar, functionally similar. Controller Firmware version CF15.0 or greater, and all associated drive initialization utilities, may be used.

4.8.1 Power-Up

As soon as the power supply voltages have stabilized, the Z-80 Controller board begins a routine which initializes the Z-80 microprocessor, and then executes a ROM-based self-test. The test checks the on-board RAM, and then a bit-sum check is done to the ROM. If the self-test fails, the Z-80 halts execution, leaving the FAULT and BUSY LEDs on, and READY LED off.

If the self-test executes successfully, the drive begins the firmware boot routine. This consists of first rezeroing the heads, bringing them over the first cylinder of the disk surfaces. The FORMAT switch is then sampled. If the switch is on, the Controller sets the READY signal. If it is off, the Controller Firmware is read from the first cylinder into the on-board RAM. If the firmware is successfully read the drive comes READY. If a bad block is encountered while reading the firmware, the Controller will attempt to read from the second copy any bad sectors found in the first. It will continue to read alternate copies from the disk until all Controller Firmware is successfully loaded into the Controller RAM.

4.8.2 Controller PCA

The Z-80 Drive Controller is responsible for interpreting commands sent from the host computer system and controlling the sub-assemblies; drive mechanism (with its Logic and/or Read/Write PCA) and Mirror PCA (when installed). The Controller reports back to the host computer the success of the command executed by means of a return code. During a write command, the Controller generates CRC bytes for each block of data written, and checks the block against the CRC value during the read command.

The Controller PCA contains the Z-80 CPU and support logic as well as Controller ROMs (containing procedural Z-80 code for the Intelligent Controller) and on-board RAM (used for buffering data to and from the disk, and utility code loaded from the Controller Firmware area of the disk). Also, four Z-80 PIO ICs are used to buffer signals to and from the Corvus Mirror, Multiplexer Network, and drive sealed mechanism. In addition, the CRC generator/checker error signal is monitored by one of the PIO ICs, and informs the Z-80 CPU in the case of a CRC error.

The Controller PCA communicates to the host computer system through a 34-pin flat cable.

4.8.2.1 Controller During Seek Command

When the drive is requested to read or write a specific sector, the Controller first verifies the sector address as valid. Next, the Read/Write PCA is then commanded to strobe the stepper motor windings (phase 1-4). The Controller decrements the cylinder count one for each full motor phase sequence (1-4) and halts the stepper motor at the appropriate cylinder. The next sector to move past the heads is read to verify the success of the seek. If the incorrect cylinder was reached, the heads are rezeroed and the seek is attempted again. If the seek fails during the retry, the drive halts operation, and an error is returned to the host operating system.

4.8.2.2 Controller During Read and Write Commands

The write command begins when the command is received, along with the sector address(es). The Z-80 Controller determines whether the write command is for 128, 256 or 512 bytes, and relinquishes control to the DMA circuitry for transfer of the data from host memory to the onboard Controller RAM.

During host-to-drive transfer, the processor is put into a wait state while the DMA circuitry transfers the data from the host memory to the on-board RAM. The DMA circuitry uses the Z-80 processor as an address counter, and when the first byte is received from the host system, the DMA circuitry uses the address specified by the Z-80 to write the byte into on-board RAM. Between data byte transfers, the Z-80 is released from its wait state just long enough to increment its address counter.

Once the data is in RAM, control is returned to the Controller which performs a seek to the appropriate cylinder, if necessary, and reads the first available header to verify the seek. The DMA circuitry clears the CRC generator/checker, and waits for the proper sector to pass under the head. If the required write function is less than 512 bytes, the block is read in from the sector and the host information is overlaid into the appropriate locations of the block.

Next, preparations are made for writing that block out to the disk. When the proper sector comes around, the Controller again turns control over to the DMA circuitry. The Drive processor again is put into a wait state while the DMA transfers data bytes one at a time to the parallel-to-serial converter. A CRC value is generated from the serial data and inserted in the data stream, and both are then sent to the read/write circuitry for output to the heads. The CRC information is used for checking data integrity when read from the disk.

The disk write operation is concluded by reading in the block to verify its success. The bus direction is then reversed, and a status byte (return code) is sent to the host system indicating the result of the disk write.

4.8.3 Backplane PCA

The Backplane PCA is responsible for transferring power and signals between the Controller PCA, Mirror PCA, Paddleboard PCA, and the Host Interface PCA (via the rear bezel 34-pin connector). The upper slot of the Backplane is reserved for the Controller PCA, and the lower slot is reserved for the Mirror PCA. These two PCAs may not be interchanged.

This two-piece PCA accepts flat cables from the front bezel Paddleboard PCA and the Drive Sealed Mechanism (Revision A only), as well as from the host computer System. A single dc power cable supplies voltage to the Backplane PCA via a four-pin connector.

The Backplane PCA for the Revision A drive is unique to that revision, and is not interchangeable with other revision drives. The Backplane PCA for the Revision B through E drives use the same Backplane PCA and is interchangeable between those four drives, but cannot be used in the Revision A drive.

4.8.4 Paddleboard PCA

The Paddleboard PCA, located on the front bezel of the drive enclosure contains switches and LEDs. The functions of these controls are detailed in chapter 2.

All Paddleboard PCA revisions are compatible with all drive revisions, and are interchangeable.

4.8.5 Interface PCA

The Corvus disk system may be configured for any of several different microcomputer systems, and may be purchased with one of many Corvus interface cards available.

The typical interface card contains address decoding, bidirectional data buffering, and handshaking circuitry. Some interface cards also have ROMs with boot routines for booting the microcomputer from the Corvus disk. Some do not, and these computers must boot from floppy diskette.

Connected to the 34-pin flat cable, the Interface PCA contains two input ports, and one output port and address decoder. One input port is an eight-bit tri-state data buffer, used for receiving data bytes during drive-to-host transfers. The other input port is the status port, used for determining the state of the disk drive. The output port is an eight-bit latch, used in host-to-drive data transfers.

When the host system needs to access the disk, it first checks the BUS DIRECTION signal, and if the bus is in the host-to-drive direction, and the READY signal is high, the drive is ready to accept a new command. The host now sends command bytes to the drive.

During a read or write command, the bus will remain in one direction without turning around, until all bytes have been transferred. The drive will acknowledge the acceptance and execution of commands by setting the bus direction bit of the status port. This is a signal that the return code is on the data bus, which must be retrieved before the drive will accept new commands.

CHAPTER 5
DISASSEMBLY

CHAPTER 5
DISASSEMBLY

5.1 Scope of Chapter

With the possible exception of the cooling fan and Backplane PCB, the Revision A, and Revisions B through E drives' configurations differ significantly. Therefore, separate disassembly instructions are given for each of these two configurations.

These two configurations were installed in different cabinet designs. Disassembly of the metal cabinet drives is covered in section 5.3, while the plastic cabinet drives are covered in section 5.4.

5.2 Introduction

The Corvus B-Series 6-Megabyte 5.25-inch disk drives were manufactured in two basic functional revisions: the Rev A, and the Rev B thru Rev E. These drives were delivered in two basic packages: the white metal cabinet, and the narrower white or gray high-impact plastic cabinet. All Rev A and Rev B drives were delivered in metal cabinets, while Rev C drives used the white plastic case. The Rev D and Rev E drives are identical to the Rev C, except the case color has been changed to grey.

WARNING:

Before disassembling any disk equipment, be sure power is disconnected.

5.2.1 Tools Required

The following tools are required for disassembly of the Corvus Revisions A through E 6-Megabyte drives:

1) #2 phillips screwdriver
2) 5/64-inch hex allendriver
3) 9/64-inch hex allendriver
4) 1/4-inch nutdriver
5) 5/16-inch nutdriver

5.3 Metal Package

The Rev A drive components differ from the Rev B components, but both use the white metal cabinet. The following instructions cover both metal packages; differences between the revisions are noted.

5.3.1 Top Cover

1. Remove the six screws securing the top cover to the basepan.
2. Remove the cover straight up, being careful not to stress the ac wiring and flat cables connected to the cover.

5.3.2 Controller PCA

5.3.2.1 Rev A Drives

1. Remove the two screws securing the Controller PCA to the cover.
2. Remove the PCA by gently pulling it out of the Backplane slot.

5.3.2.2 Rev B Drives

1. Remove the drive mechanism flat cable from the upper connector of the Controller PCA noting its orientation.
2. Remove the two allen screws securing the PCA to the cover.
3. Remove the PCA by gently pulling it out of the Backplane slot.

5.3.3 Backplane PCA

5.3.3.1 Rev A Drives

1. Disconnect the one dc power cable and two 34-pin flat cables from the Backplane, noting their orientation.
2. Remove the four phillips screws securing the angle brackets to the cover.
3. Remove the Backplane by moving it down and forward.

5.3.3.2 Rev B Drives

1. Disconnect the one dc power cable and one flat cable from the backplane, noting their orientation.
2. Remove the four allen screws securing the Backplane to the cover.
3. Remove the Backplane by moving it down and forward.

5.3.4 Drive Mechanism

1. Remove the four allen screws securing the drive mechanism mounting brackets to the basepan.
2. Remove the dc power cable(s) and flat cable from the drive mechanism.
3. Remove the drive mechanism and brackets up and out of the basepan.
4. Remove the four allen screws securing the bracket(s) to the drive mechanism, and remove the bracket(s).

5.3.5 Power Supplies

5.3.5.1 Rev A Drives

NOTE:

The two power supplies in the Rev A drive share common wiring and must be removed together.

1. Disconnect the two ac wiring harness connectors from the rear bezel CORCOM unit and power switch.
2. Disconnect the dc wiring cables from the drive mechanism and the Backplane PCA.
3. Disconnect the ac fan cord from the cooling fan.
4. Remove all eight allen screws securing the two power supplies to the basepan.
5. Remove the power supplies, together, straight up and out of the basepan.

5.3.5.2 Rev B Drives

1. Disconnect the ac wiring harness connector from the rear bezel CORCOM unit and power switch.
2. Disconnect the dc wiring cables from the drive mechanism and the Backplane PCB.
3. Disconnect the ac fan cord from the cooling fan.
4. Remove the four screws securing the power supply to the basepan.
5. Remove the power supply straight up and out of the basepan.

5.3.6 Front Bezel

1. Remove the flatcable from the front bezel paddleboard PCA, noting its orientation (one edge down).
2. Remove the four allen screws securing the front bezel to the support brackets.
3. Remove the bezel straight forward.

5.4 Plastic Package

The high-impact plastic case was implemented with the Rev C, Rev D and Rev E drives. These drives share the same components as the metal case Rev B drive.

5.4.1 Top Cover

1. Remove the two screws at the rear of the cover.
2. Remove the cover by sliding it back and lifting it straight up. Be careful not to stress the dc cabling and flat cables connected to the Controller PCA and the Backplane PCA.

5.4.2 Controller PCA

1. Remove the drive mechanism flat cable from the upper connector of the Controller PCA noting its orientation (one edge to the left).
2. Remove the two nylon standoffs (allen screws are found in some instances) securing the PCA to the cover.
3. Remove the PCA by gently pulling it out of the Backplane slot.

5.4.3 Backplane PCA

1. Disconnect the one dc power cable and one flat cable from the Backplane, noting their orientation.
2. Release the forward Backplane PCA from the nylon standoffs (in some drives the allen screws must be removed to accomplish this).
3. Remove the five nylon stand-offs securing the Backplane to the cover.
4. Remove the Backplane by moving it down and forward.

5.4.4 Drive Mechanism

1. Remove the four allen screws securing the drive mechanism mounting brackets to the basepan.
2. Remove the dc power cable and flat cable from the drive mechanism.
3. Remove the drive mechanism and brackets up and out of the basepan.
4. Remove the four screws securing the bracket(s) to the drive mechanism, and remove the bracket(s).

5.4.5 Power Supply

1. Disconnect the ac wiring harness connector from the rear bezel CORCOM unit and power switch.
2. Remove slot screw securing the ground wire to the power supply.
3. Be sure the dc wiring cables are disconnected from the drive mechanism and the Backplane PCA.
4. Disconnect the ac fan cord from the cooling fan.
5. Remove the four allen screws securing the power supply to the basepan.
6. Remove the power supply straight up and out of the basepan.

5.4.6 Front Bezel

1. Remove the flat cable from the front bezel Paddleboard PCA, noting its orientation (one edge down).
2. Remove the three screws securing the front bezel to the basepan.
3. Remove the bezel straight forward.

CHAPTER 6
ADJUSTMENTS AND MAINTENANCE

CHAPTER 6
ADJUSTMENTS AND MAINTENANCE

6.1 Scope of Chapter

This chapter will cover the check and adjustment of power supply voltages. The Corvus B-Series 6-Megabyte drive has no other adjustments.

6.2 Introduction

The Corvus disk system is based on a Winchester disk mechanism. Because of this storage device's sealed environment, this mechanism requires no preventive maintenance.

6.3 Power Supply Voltage Check and Adjustment

Aging of the power supply and normal heating and cooling of the drive electronics can cause the power supply voltages to drift over time. Voltages should be checked each time the installation is visited for system checkout.

WARNING:

Extreme caution should be exercised when adjusting the power supply. High voltages present a potential hazard.

6.3.1 Rev A Drives (Dual Power Supplies)

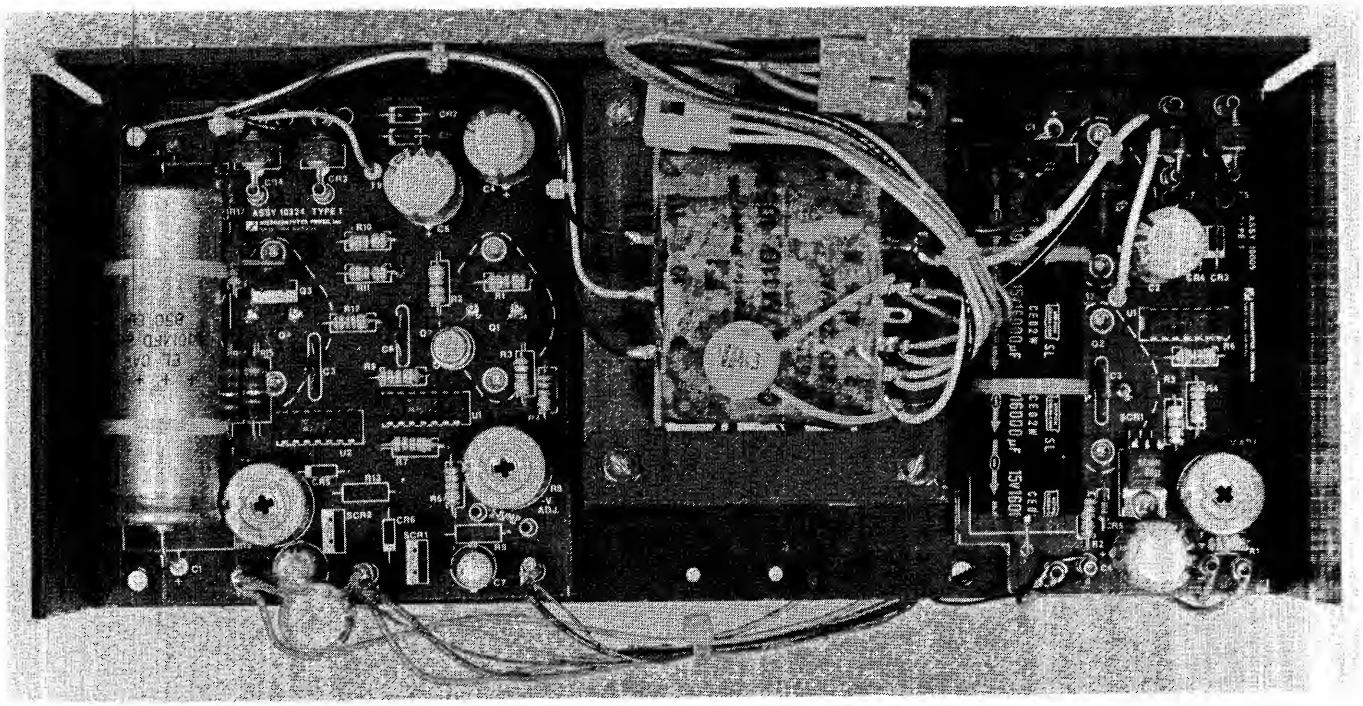

Figure 6-1. CP134 Power Supply from Rev A Drive

6.3.1.1 Voltage Check (CP134):

1. Remove cover to the enclosure as outlined in chapter 5.
2. Locate voltage test points at the edge of the CP134 power supply (larger of the two). These are labeled +V, COM, COM, -V.
3. Turn on the ac power switch.

4. Using a DIGITAL voltmeter, check the power supply voltages at these connections, using the corresponding COMMON test point for each voltage. All voltages must be within ± 0.1 volts of the specified voltage.
5. If any of the voltages are out of tolerance, follow the adjustment procedure for this supply.

6.3.1.2 Voltage Adjustment (CP134):

1. Remove the ac power from the disk drive.
2. Remove the cover to the enclosure as outlined in chapter 5.
3. Connect the ac power to the disk drive, and turn on the ac power switch.
4. Monitoring the dc voltages as outlined above, adjust the -12V, and +12V using the following adjustments:

CP140

R-19	+12V
R-8	-12V
R-5	-5V

NOTE:

During adjustment, one of the voltages may drop to or near zero. This is due to the over-voltage protection circuitry being activated. To reset this condition, turn off the ac power switch, and bleed the particular voltage to ground using a 10-K resistor. Set the trim resistor to its original position, turn on ac power and proceed with the adjustment.

5. Turn off the ac power switch.
6. Replace the drive cover and screws.

6.3.1.3 Voltage Check (HB5):

1. Remove the cover to the enclosure as outlined in chapter 5.
2. Locate the voltage test points at the edge of the HB5 power supply (smaller of the two). These are labeled +V, COM, -V.
3. Turn on the ac power switch.
4. Using a DIGITAL voltmeter, check the power supply voltages at these connections, using the corresponding COMMON test point. All voltages must be within ± 0.1 volts of the specified voltage.
5. If any of the voltages are out of tolerance, follow the adjustment procedure for this supply.

6.3.1.4 Voltage Adjustment (HB5):

1. Remove the ac power from the disk drive.
2. Remove the cover to the enclosure as outlined in chapter 5.
3. Connect the ac power to the disk drive, and turn on the ac power switch.
4. Monitoring the dc voltages as outlined above, adjust the +5V using the following adjustments:

CP140

R-2	+5V

NOTE:

During adjustment, the +5V may drop to or near zero. This is due to the over-voltage protection circuitry being activated. To reset this condition, turn off the ac power switch, and bleed the +5V charge to ground using a 10-K resistor. Set the trim resistor to its original position, turn on the ac power and proceed with the adjustment.

5. Turn off the ac power switch.
6. Replace the drive cover and screws.

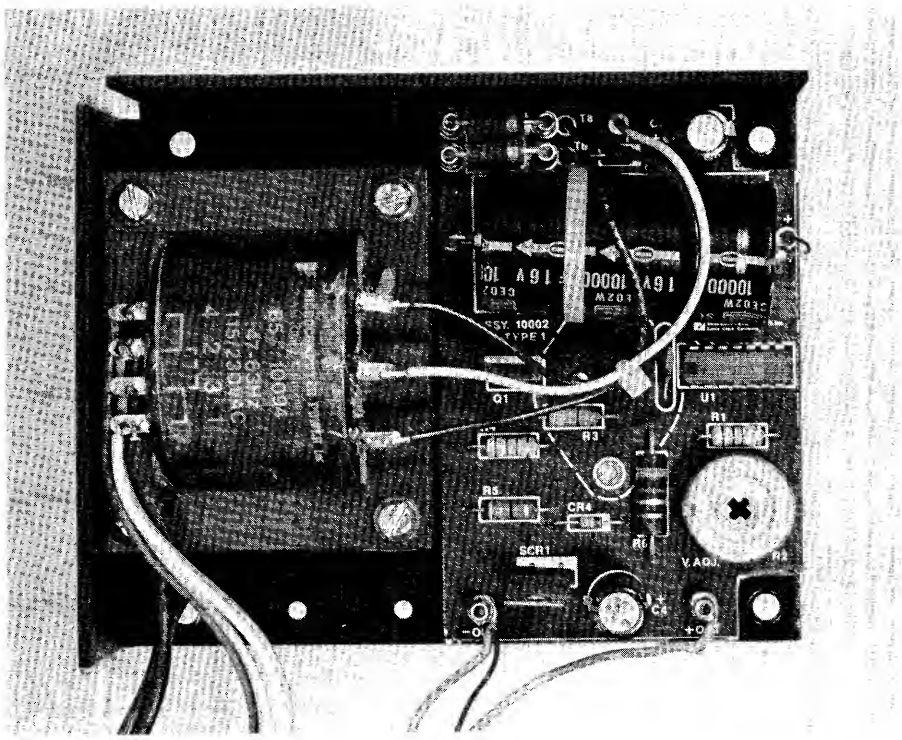

Figure 6-2. HB5 Power Supply from Rev A Drive

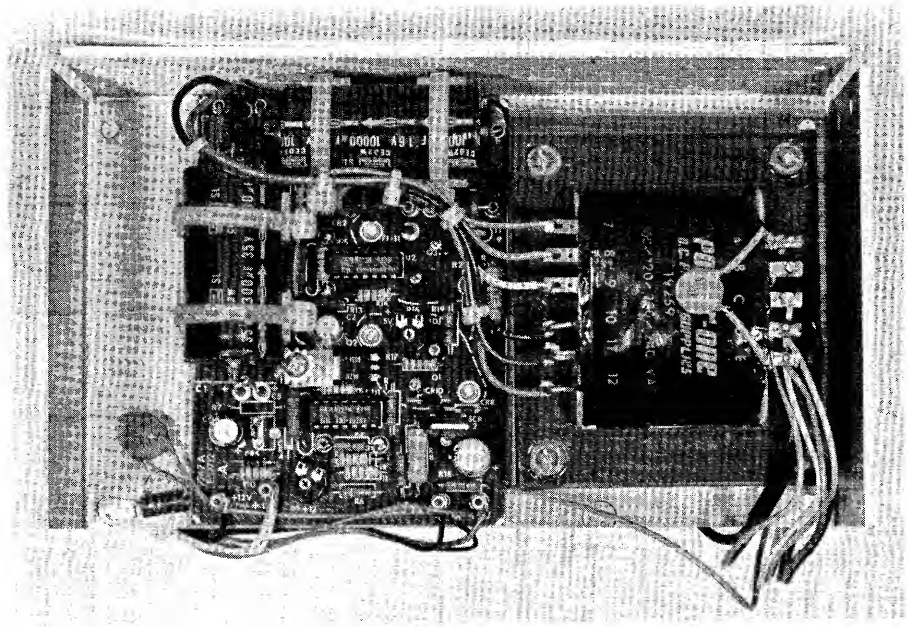

Figure 6-3. CP417 Power Supply from Rev B-E Drives

6.3.2 Rev B - Rev E Drives (Single Power Supply)

6.3.2.1 Voltage Check (CP417):

1. Remove the cover to the enclosure as outlined in chapter 5.
2. Locate the voltage test points at the edge of the CP417 power supply (smaller of the two). These are labeled +OUT, -OUT.
3. Turn on the ac power switch.
4. Using a DIGITAL voltmeter, check the power supply voltages at these connections, using the corresponding common test point. All voltages must be within ± 0.1 volts of the specified voltage.
5. If any of the voltages are out of tolerance, follow the adjustment procedure for this supply.

6.3.2.2 Voltage Adjustment (CP417):

1. Remove the ac power from the disk drive.
2. Remove the cover to the enclosure as outlined in chapter 5.
3. Connect the ac power to the disk drive, and turn on the ac power switch.
4. Monitoring the dc voltages as outlined above, adjust the +5V using the following adjustments:

   CP417

R-9	+12V
R-16	+5V

   NOTE:

   During adjustment, the +5V or +12V may drop to or near zero. This is due to the over-voltage protection circuitry being activated. To reset this condition, turn off the ac power switch, and bleed the +5V or +12V charge to ground using a 10-K resistor. Set the trim resistor to its original position, turn on the ac power and proceed with the adjustment.

5. Turn off the ac power switch.
6. Replace the drive cover and screws.

CHAPTER 7
DEALER SERVICE DIAGNOSTICS

CHAPTER 7
DEALER SERVICE DIAGNOSTICS

7.1 Scope of Chapter

The Dealer Service Diagnostic Utilities are supplied to aid the technician in tracing faults in the Corvus disk drive system, and speed the correction of these faults. The Drive Diagnostic, Controller Diagnostic, and Burn-In Diagnostic utilities are covered in this chapter. The Mirror and OMNINET Diagnostics are covered in the service manuals for those products.

7.2 Introduction

Each Authorized Corvus Dealer Service Center will be supplied with Dealer Service Utilities. These utilities will help the technician exercise and diagnose the Corvus disk and network systems.

The Dealer Service Utilities diskette is comprised of standard Drive Diagnostic for all the Corvus disk drives (including the H-Series drives), Controller Diagnostic which will exercise and diagnose the drive utilizing the drive Z-80 processor, and a rigorous Burn-In program which exercises and tests the drive system infinitely (i.e. overnight). Also included is a single-track read-write diagnostic, for determining the condition of an individual track.

Some versions of the diagnostic utilities display only 40 characters on the video monitor. When viewing the diagnostic menu under each specific item, typing a question mark (?) will display an additional 40 characters of menu options.

The latest release of Dealer Service Diagnostics covers all series of Corvus disk drives:

A-Series:
- 8-inch, 11-Megabyte drive (Revision A)

B-Series:
- 8-inch, 11-Megabyte drive (Revision B)
- 8-inch, 20-Megabyte drive (Revision B)
- 5.25-inch, 6-Megabyte drives (All)

H-Series:
- 5.25-inch, 6-Megabyte drives (All)
- 5.25-inch, 12-Megabyte drives (All)
- 5.25-inch, 18-Megabyte drives (All)

7.3 Drive Diagnostics (DRVDIAG)

This program is essentially the same program provided on the Initialization Utility diskettes supplied with each Corvus drive. All options within this program are non-destructive to data on the drive, with the exception of the Format utility. While the PARAMETERS option of the diagnostic program does not actually destroy data, changing these values using this diagnostic option will change relative track and sector addresses which will make the data inaccessable.

7.3.1 CRC

A good sector is defined as one capable of retaining all bits in the order they were written. When a block is read from a sector, the CRC value is read with it and tested. Bit errors may occur due to a bad sector, damaged in one of two ways:

1) physically (faulty media resulting in dropped bits and mismatched CRC bytes)

2) magnetically (miscellaneous bits written to the block resulting in a mismatched CRC value)

The Cycle Redundancy Check (CRC) test is a non-destructive test which reads each block of data, and checks it against its CRC value. If for any reason, the CRC value in that sector does not match the block of data, the CRC checker/generator signals the controller that an error has been detected, and the processor halts operation. Any errors will be reported at the end of the program. CRC errors encountered during normal drive operation will halt disk drive operation with the error code displayed.

Run this test several times to determine whether the error is due to faulty media (where specific sectors will repeatedly show errors) or random magnetic bit changes (where sectors will show one-time errors). Tracks containing sectors with repeated errors should be spared (using Drive Diagnostic utility PRM).

7.3.2 EXR

The exercise test (EXR) seeks random sectors and reads the header information from that sector to verify the success of the seek. Periods print to the video display for successful operations, asterisks for hard errors (errors that exist after ten retrys) and question marks for soft errors (operations that succeed after at least one retry).

Pressing <RETURN> displays the error list, consisting of total number of passes (seeks), hard and soft errors. Any errors reported should be followed by a CRC test to check for faulty sectors.

7.3.3 UPD

The Controller Firmware Update utility rewrites a new copy of Controller Firmware into each of the first two cylinders of the drive. All B-Series 6-Megabyte drives must use Controller Firmware version CF15.0 or greater.

Since it is not possible to update the firmware on the boot drive, the system MUST first be booted from another boot device (another Corvus Drive, or floppy diskette).

Some versions of this utility will prompt you with:

Change Tables? (Y/N)

A negative answer to this question will not endanger data resident on the drive. Although the UPDate utility is non-destructive to the data itself, answering affirmatively to this will result in these tables being rewritten with default values:

Spare Track table = No Tracks Spared
VDO table: Drive1 = 0
Interleaving Spec = 9

This default Interleaving Spec is incorrect for the B-Series 6-Megabyte drive. Whenever the drive is formatted, or the firmware updated, this parameter must be checked and changed to 12 if needed. Be aware that whenever these default table values are written to the firmware area (by answering YES to "Change Tables?"), they replace previous values that may have been written at an earlier time. These may include spared tracks, and Interleaving Specification. If data is resident on the drive when these values are changed, all relative references to the data (absolute sector addresses) will be changed, and the data will be inaccessable afterwards.

The Format program will also rewrite these default table values.

Next, the program will display a Controller Firmware file name. This will be in the form of:

ENTER CONTROLLER CODE FILE: CFxx.x

The current level of Controller Firmware for B-Series drives at this writing is CF18.4AP. If another version is to be used, it should be entered now. The version of Controller Firmware used on the drive should be none other than that supplied with the Corvus initialization diskettes that were used when the drive was originally initialized.

7.3.4 VSN

This utility displays the current versions of the Controller Firmware and controller ROMs:

DRIVE 1: Vxx.x CORVUS SYSTEMS DD-MMM-YY
CONTROLLER ROM VERSION: nn

where DD-MM-YY represents the release date of that Controller Firmware version, xx.x represents the Controller Firmware version (i.e. CF18.4AP) and nn represents the suffix of the controller ROM (i.e. 7.63). At this printing, the current versions are:

Controller Firmware: CF18.4AP
Controller ROMS: 7.58, 8.58

7.3.5 FMT

WARNING:
This utility will destroy data on the drive.

Although the Format utility should be used only as a last resort when attempting to re-establish normal drive operations, the drive may at some time need reformatting. This diagnostic-level, or bottom-level format writes the rudimentary magnetic pattern to each sector required before data may be retained properly. This format must be intact before the drive can be initialized for any operating system or data storage using Corvus initialization software.

First turn the front bezel FORMAT switch to the ON (right) position, then execute the Format utility. Some versions of this utility request a password, which is HAI. When the Format has completed, the program will display:

```
FORMAT COMPLETE - NOW UPDATING FIRMWARE
ENTER CONTROLLER CODE FILE: CFxx.x
```

The program will now rewrite the Controller Firmware using the input file displayed. If another version of firmware is to be used, enter the filename now. Use only the Controller Firmware version appropriate for the drive (see section 7.3.3 "UPDATE").

The Format program writes default Drive Parameters to the drive:

```
Spare Track table    = No Tracks Spared
VDO table: Drive1 =  0
Interleaving Spec    = 9 (Must be changed to 12 after FORMAT)
```

and should be updated as necessary after the Format program terminates (see section 7.3.3 "UPDATE," and section 7.3.6 "PARAMETERS").

7.3.6 PRM

The Parameter option of the diagnostic program allows the checking and alteration of the Constellation Mulitplexer parameters (including Master Multiplexer Configuration table and Polling Parameters) and Drive Parameters (including Spare Track table, Sector Interleaving Specification and Virtual Drive Offset table).

7.3.6.1 MUX

Selecting this option displays the Multiplexer table:

```
M     M
M     M
M     M
M     M
   X
```

As displayed above, the Multiplexer table is not to be altered if the drive is not connected to a Corvus Multiplexer network, or is connected to a single, Host Multiplexer.

Only if a Master Multiplexer is used in the Multiplexer Network is this table to be changed. In the instance that a Master Mux is installed, each of the eight ports (M in the above table) should be changed to either "N" if no device is connected to the port, "C" if a computer other than a DEC-System LSI-11 is connected to the port, or "L" when an LSI-11 is used, or left an "M" if a Host Mux is connected to that port.

There is only one MUX table, and it should be changed to reflect the configuration of the Master Multiplexer only, or left unchanged if only a Host Mux is used.

Polling Parameters is the next option of the program. When the drive is used with a Corvus Multiplexer local network with Intertec Superbrain™ or Radio Shack TRS-80™ computers, the Polling Parameters should be changed:

Standard Polling parameters: 180,16,32,0
For Superbrain and TRS-80: 180,32,32,0

7.3.6.2 DRIVE

Selecting this option displays the Spare Track table, Sector Interleaving Specification, and Virtual Drive Offset table.

Whenever a track is found to contain a faulty sector (via the CRC test), that track must be removed from service, and a spare track used. These bad tracks are eliminated by listing them in the Spare Track table. This utility enables the user to:

ADD a track to the Spare Track table (remove it from use)

DELETE a track from the Spare Track table (restore it to use)

LIST the Spare Track table

QUIT or exit from the spare track routine

By selecting the ADD option, the track number returned by the CRC test (see CRC below) can be entered, thereby ignoring the track with the erring sector.

The Sector Interleaving Specification is the next option of the program. Interleaving, or skewing, is defined as the use of an offset constant in the logical numbering of sectors. This value for all B-Series drives is twelve for all computer systems except the DEC System LSI-11 which uses a value of five.

Check the Interleaving Specification when the drive is first received, and whenever it is formatted.

Next, the Virtual Drive Offset table should read:

DRIVE 1 0

unless otherwise instructed by the Corvus "Disk System Installation Guide." This table should be checked when the drive is first received, and whenever the drive is formatted.

7.3.7 SET

This utility allows the user to change the slot number, drive number, or drive type of the drive to be diagnosed. This allows the technician to connect several drives to one host computer, and test any one.

7.3.8 QUIT

Selecting this option exits the program, and returns the user to the main Dealer Service menu.

7.4 Controller Diagnostic

The purpose of the Controller Diagnostic program is to provide comprehensive testing for the Corvus disk drives. Some of these utilities are designed for use when adjusting the servo mechanism on the Corvus 8-inch, 11-megabyte and 20-megabyte disk drives, and will not be used with the 6-megabyte drives. These few utilities are included here only because they are provided on all Dealer Service Diskettes.

7.4.1 General Description:

The Controller Diagnostic program is a combination of Z-80, host system machine code and high-level language programs which allow the technician to directly communicate to the intelligent controller of the disk drive. The code breaks down into three parts as follows:

High-level language terminal program: The high-level portion of the program makes the host computer a semi-intelligent terminal which can communicate with the drive controller. There are several features implemented in the high-level program, such as base conversions, slot selection and the driver which downloads the code to the drive controller.

CHAPTER 8
FAULT ISOLATION PROCEDURES

Host system machine code: The machine code provides the low-level interface to the drive controller. It transmits and receives data from the controller according to the parameters passed to it by the high-level program. It is slot selectable and contains a one second time-out feature which allows the program to recover if the drive is not responding.

Z-80 code: The Z-80 code is the heart of the diagnostic and is the largest portion of the program. It performs the commands which are passed to it by the high-level program via ASCII characters. It consists of three blocks of code which are loaded to different locations in the controller memory.

7.4.2 Controller Diagnostic Commands

The following is a detailed description of each function of the Controller Diagnostic commands. Please note that there should be no spaces in the commands unless the notation <space> is specified.

Whenever the entry of a Controller Diagnostic command results in the response

"x (Y/N)?"

where x is the command entered, be sure the continuation of this test is appropriate; THESE COMMANDS ARE DESTRUCTIVE TO DATA.

During normal operation, when an error is encountered, the controller will repeat the operation in an attempt to succeed. All errors returned by the Controller Diagnostic are reported without retrying the command.

7.4.2.1 A) ABORT DIAGNOSTIC:

This command allows the operator to leave the diagnostic and return to the command level of the operating system. The format for this command is:

A<return>

7.4.2.2 B) MACRO MENU:

This command allows the operator to create a Macro program. The computer will prompt you with:

W)RITE MACRO X)ECUTE MACRO

Enter W to create a Macro program. The format for this command is:

W<return>

The computer will return with the prompt:

ENTER COMMANDS FOLLOWED BY<RETURN>
TO END ENTRY, TYPE 'END'<RETURN>

Enter single-letter Controller Diagnostic commands from this Controller Diagnostic menu, one at a time, each followed by<return>. The Macro list should begin with the DOWNLOAD command and terminate with "END." The computer will then prompt you with:

DATA OK?

Entering a "n" will return the Controller Diagnostic command prompt. Entering a "Y" will result in the computer prompt:

ENTER MACRO FILENAME =>

Enter the name you wish to call the Macro program you have just created (maximum 11 characters). The computer will respond with:

* MACRO FILE WRITTEN TO DISK *

The Macro file can be executed by selecting "X" from the Macro Menu. The computer will prompt you for the filename:

ENTER MACRO FILENAME =>

Enter the filename of the Macro program you have previously created, and press<return>. The Macro program will begin execution:

* EXECUTING MACRO ==> xx.MAC *

and finish with:

* END OF MACRO PROGRAM *

A sample Macro program with the name of "TEST" is on the Dealer Service Utilities diskette.

7.4.2.3 C) CHANGE SLOT NUMBER:

This command allows the operator to change the computer slot number of the drive under test. The default value is set to slot 2 at the start of execution. (Note: It is possible to have multiple drives under test by starting execution, then changing slot numbers. You will have to return to the original slot to view test results.) The format for this command is:

C<return>

The computer will prompt you for the slot number as follows:

ENTER SLOT NUMBER (DEFAULT=2) ?

Enter the slot number desired and press<return>.

7.4.2.4 D) DOWNLOAD DIAGNOSTIC:

This command must be executed before any of the tests can be performed on the drive. This command loads the Z-80 code into the memory of the drive controller. The FORMAT switch must be on before downloading the diagnostic in order for the program to function correctly. The format for this command is:

D<return>

7.4.2.5 I) ANALYZE SERVO:

This command is used in the adjustment of the 8-inch disk drive.

7.4.2.6 J) SINGLE DO SEEK:

This command is used in the adjustment of the 8-inch disk drive.

7.4.2.7 L) FULL CYLINDER LOOPSEEK:

This command instructs the controller to continuously seek from cylinder zero to the maximum cylinder. This command can be used to check servo action and to adjust the servo board (8-inch drives only), or as a general servo exercise utility for all drives. The Controller will continue seeking until a new command is issued. The format for this command is:

L<return>

7.4.2.8 P) PRINT QUIET SUMMARY REPORT:

This command allows the operator to view the results of the sector quiet, seek scan, read scan and write scan commands. The results are printed in the following format:

1) SEEK ERRORS:

   Seek errors are represented in the following format:

   ccc:ddd:ee

   where ccc is the desired cylinder in decimal, ddd is the cylinder in decimal which was actually found and ee is the error code. See the error codes in section 8.4.3.

2) CRC ERRORS:

CRC errors are represented in the following format:

ccc-h xxxxx

where ccc is the cylinder number in decimal, h is the head number in decimal, and xxxx is the number of errors in decimal.

3) TOTAL SEEKS:

This number represents the number of seeks the controller has performed so far. The number will be in decimal.

4) SEEK TIME:

This number represents the total time spent performing seeks in milliseconds. The average seek time can be calculated by dividing seek time by the number of seeks.

5) RPM:

These numbers represent the minimum and maximum speed of the drive during the execution of the sector quiet diagnostic.

7.4.2.9 Q) SECTOR QUIET PROGRAM:

CAUTION:
This command will DESTROY data on the disk.

This command instructs the controller to begin executing the sector quiet diagnostic. This diagnostic is a very comprehensive test of the drive media and electronics. The controller performs continuous seeks, reads and writes at random locations on the disk. The results of this test are obtained by the P command documented in 8.4.2.8. The format of this command is:

Q<return>

The controller will respond with:

Q (Y/N) ?

Enter Y<return> to begin the test, enter N to abort. The controller will continue this test until a new command is issued.

7.4.2.10 S) READ SCAN DISK:

This command instructs the controller to perform a sector verify pass (CRC check). The results of the scan will be added to the sector quiet results which are available thru the command documented in 8.4.2.8. The format for this command is:

S<return>

The controller will continue to read scan the disk until a new command is issued.

7.4.2.11 T) SINGLE CYLINDER SEEK SCAN:

This command instructs the controller to single step across the disk. This can be used to observe the servo tracks on the 8-inch drives as the heads move across the platters. The format of the command is:

T<return>

The controller will continue to seek scan until a new command is issued.

7.4.2.12 X) WRITE SCAN DISK:

CAUTION:
This command will DESTROY data on the disk.

This command instructs the controller to perform a bottom level format of the drive. This will not write Controller Firmware, it will simply format the entire disk. The format for this command is:

X<return>

The controller will respond with:

X (Y/N) ?

Enter Y to write scan the disk, enter N to abort. The controller will continue to write scan the disk until a new command is issued.

7.4.2.13 Y) REZERO HEADS:

This command instructs the controller to position the heads on cylinder zero. The format for this command is:

Y<return>

7.4.3 Error Codes

The error codes returned by the command documented in 8.4.2.8 are as follows:

00 — hardware detected fault in read or write
01 — heads move off track while not seeking
02 — seek time out
03 — phase lock oscillator error (PLO)
04 — sector CRC error
05 — cylinder address mismatch
06 — read after write verify error
07 — guard band detected in data region
08 — read sector time out
09 — write sector time out
10 — bad track list overflow
11 — sector locate error

7.5 Burn-In Program

THIS PROGRAM IS DESTRUCTIVE TO DATA. Be sure a back-up of the data exists before proceeding.

Selecting the Burn-In program will automatically begin the polling of the host computer slots. The program determines the type of drive in each slot, and the burn-in procedure begins on all drives attached to the host system.

The Burn-In program is a rigorous read-write routine which steps through the drive one chunk (256-sector quantity) at a time, reading and writing specific patterns to each of the sectors. The program divides the disk media into chunks by dividing the total number of sectors by 256.

The Burn-In program begins with the highest chunk number. When the read/write test is completed for the current chunk, a random 256-sector read test is executed over the complete disk drive. When this is complete, the chunk number is decremented by one, and the test repeats.

The program may be halted at any time by pressing the<return> key or the SPACE bar. This displays a sub-menu:

C)ONT L)IST R)ESTART Q)UIT

7.5.1 C)ONT

Entering a "C" will cause the program to continue from where it left off.

7.5.2 L)IST

Entering a "L" will cause the error list to be displayed (for example):

```
*** SLOT NUMBER 2 ****
CURRENT TIME = 0,75
TOTAL ERRORS: 0
HARD ERRORS : 0
SOFT ERRORS : 0
DO YOU WANT A COMPLETE LIST (Y/N)?
```

Slot number refers to the host slot to which the disk drive is interfaced. Current time refers to A) the pass number and B) the current chunk being tested.

Errors are those disk read or write errors which, after 15 rereads or 3 rewrites, are still in error. Soft errors are those read or write errors which, after at least one retry, have been corrected. Requesting a complete list will result in a display of the specific tracks with the error results for each (refer to section 9.4 for detailed information on error codes).

7.5.3 R)ESTART

Entering an "R" will begin the program again from the beginning. All error counters will be rezeroed.

7.5.4 Q)UIT

Entering a "Q" will return to the Dealer Service Diagnostic menu.

7.6 READ BURN-IN RESULTS

This program allows the burn-in results of all drives to be output to the video display or printer:

```
*** SLOT NUMBER n ***
CURRENT TIME = p,cc
TOTAL ERRORS: x
HARD ERRORS : y
SOFT ERRORS : z
[followed by a detailed listing of all errors]
```

where n is the number of the slot to which the drive is connected, p is the pass number, cc is the current chunk being tested, and x,y and z are the total errors, hard errors, and soft errors, respectively.

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CHAPTER 8
FAULT ISOLATION PROCEDURES

8.1 Scope of Chapter

This chapter contains procedures for diagnosing and testing all revisions of the Corvus B-Series 5.25-inch 6MB disk drives. Recommended test equipment is listed, as are error codes. A list of common failures and solutions may be found at the end of this chapter.

8.2 Introduction

The drive is a sophisticated electronic device, and may, at some time, fail. When failure occurs, it may be due to the failure of any of the drive components. The following procedures will aid the technician in isolating the faulty component.

8.3 Tools

The following test equipment is recommended as a minimum for troubleshooting and repair of the Corvus disk drive:

1. Digital voltmeter (± 0.1 percent accuracy), with test leads
2. Host microcomputer: Corvus Concept (256K) or Apple II+ (48K), Corvus Interface PCA and 34-pin flatcable
3. Corvus Dealer Service Diagnostic Utilities diskette (currently these are available for the Corvus Concept and Apple II computers)

8.4 Error Codes

For each command sent to the drive by the host operating system, a single-byte return code is received after the commmand is executed. It is the responsibility of the operating system to interpret the error code and take appropriate action. All errors reported by the Corvus Diagnostic Utilities are in hexidecimal notation.

Errors returned by the controller are listed below. Errors less than or equal to 127 (decimal) are non-fatal. Those errors greater than or equal to 128 are fatal errors, causing normal drive operation to cease.

The bit format of the error code is shown below:

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

The eight-bit error code is broken into four segments. Bit 7, when set, indicates that the reported error is a fatal error. Bit 6, when set, indicates that the reported error occurred during the verify (read after write) sequence of the write command. Bit 5, when set, indicates that one or more retrys were attempted before the error was reported. Bits 0-4 represent one of the 21 codes which describe the error (refer to the error lists in section 8.4.1).

8.4.1 Interpreting Error Codes

As can be seen in the error code tables below, there are up to four different error codes for each error condition. To determine the actual error condition, these procedures should be followed:

1. If the error code value is greater than or equal to 128, a fatal error occurred. Subtract 128 if the value is greater than or equal to 128.
2. If the remaining value is less than 64, the error occurred during a disk read. If the value is greater than or equal to 64, the error occurred during the verify portion of a write command. Subtract 64 if the value is greater than or equal to 64.
3. If the remaining value is less than 32, no retrys were attempted. If the value is greater than or equal to 32, at least one retry was attempted before the error was reported.

If no error has occurred, the original error code value of zero will be returned.

Consistent 171 or 235 errors at the same block location indicate bad disk media. Execute the CRC test and follow the instructions for sparing tracks (PRM option, Drive Diagnostics).

Consistent 255 errors indicate that the Controller PCA is not responding to commands sent from the Host Computer, and replacing the Controller may be in order.

Table 8-1. Decimal Disk Error Codes

≤127 Non-Fatal		≥128 Fatal		
32				soft error
	128	160	192	224 error in preparing R/W
	129	161	193	225 seek timeout
	130	162	194	226 seek fault
	131	163	195	227 seek error
	132	164	196	228 header CRC error
	133	165	197	229 rezero timeout
	134	166	198	230 rezero fault
	135	167	199	231 drive not online
	136	168	200	232 write fault
	137	169	201	233 format protected
	138	170	202	234 read fault
	139	171	203	235 data CRC error
	140	172	204	236 sector locate error
	141	173	205	237 write protected
	142	174	206	238 illegal sector address
	143	175	207	239 illegal command op code
	144	176	208	240 spare track table overflow
	145	177	209	241 overlay failure
				254 verify error (burn-in test)
				255 controller timeout (diagnostic utilities)

Table 8-2. Hexidecimal Disk Error Codes

≤7FH Non-Fatal		≥80H Fatal		
20				soft error
	80	A0	C0	E0	error in preparing R/W
	81	A1	C1	E1	seek timeout
	82	A2	C2	E2	seek fault
	83	A3	C3	E3	seek error
	84	A4	C4	E4	header CRC error
	85	A5	C5	E5	rezero timeout
	86	A6	C6	E6	rezero fault
	87	A7	C7	E7	drive not online
	88	A8	C8	E8	write fault
	89	A9	C9	E9	format protected
	8A	AA	CA	EA	read fault
	8B	AB	CB	EB	data CRC error
	8C	AC	CC	EC	sector locate error
	8D	AD	CD	ED	write protected
	8E	AE	CE	EE	illegal sector address
	8F	AF	CF	EF	illegal command op code
	90	B0	D0	F0	spare track table overflow
	91	B1	D1	F1	overlay failure
				FE	verify error (burn-in test)
				FF	controller timeout (diagnostic utilities)

Table 8-3. Signed Decimal Disk Error Codes

≤-129 Non-Fatal	≥-128 Fatal			
-224				soft error
	-128	-96	-64	-32	error in preparing R/W
	-127	-95	-63	-31	seek timeout
	-126	-94	-62	-30	seek fault
	-125	-93	-61	-29	seek error
	-124	-92	-60	-28	header CRC error
	-123	-91	-59	-27	rezero timeout
	-122	-90	-58	-26	rezero fault
	-121	-89	-57	-25	drive not online
	-120	-88	-56	-24	write fault
	-119	-87	-55	-23	format protected
	-118	-86	-54	-22	read fault
	-117	-85	-53	-21	data CRC error
	-116	-84	-52	-20	sector locate error
	-115	-83	-51	-19	write protected
	-114	-82	-50	-18	illegal sector address
	-113	-81	-49	-17	illegal command op code
	-112	-80	-48	-16	spare track table overflow
	-111	-79	-47	-15	overlay failure
				-2	verify error (burn-in test)
				-1	controller timeout (diagnostic utilities)

8.5 Troubleshooting Procedures

When a disk drive fails to function normally, the problem may range from a faulty sector to total drive failure. It is the responsibility of the service technician to interpret the symptoms, isolate the faulty component, substitute with a replacement, and thoroughly test the drive before returning it to the user.

Corvus provides its Authorized Servicing Dealers with diagnostic utilities and service documentation to aid the technician in servicing Corvus products. The Dealer Service utility diskettes include diagnostics for testing all phases of drive operation. These utilities are described in chapter 7, "Diagnostics."

In using the troubleshooting aids provided, take the following precautions:

1. Make sure all drives have the appropriate version of Controller Firmware.
2. See that the drive has the latest release of controller ROMs.
3. Be sure to disconnect the ac power cord before removing or replacing any modules.
4. Use only known good components when substituting.
5. Retest the system after each component has been substituted.

8.5.1 On-Site Checks

There are several quick checks that can be taken that do not require disassembly of the drive:

1. Be sure the ac power cable is plugged in, and the power switch is turned on.
2. Examine the front bezel switches to verify their proper settings.
3. On the rear bezel, check that the four Mirror DIP-switches are set correctly to reflect the internal Mirror configuration.
4. Check that the CORCOM unit (located on the rear bezel) has the correct line voltage and fuse selected.
5. Verify that the interface cable is not damaged, and has been properly connected at both ends.
6. Check to see that the Interface PCA is in the correct bus slot (where applicable) of the host computer.
7. Check that the drive's Controller Firmware is intact (section 8.5.3.2).

8.5.2 Isolate the Problem

Malfunctions in the Corvus disk system may be divided into four catagories:

1. Magnetic, or software (Controller Firmware integrity, data integrity, format integrity, boot image integrity),
2. Physical media damage (imperfections in media surface)
3. Electronic (host computer function, Corvus drive sealed mechanism and associated Read/Write PCA and Logic PCA, Z-80 controller, or power supply)
4. Environmental (power stability, temperature and humidity limits).

The first step in analyzing faults in the Corvus disk system is to isolate the drive from other devices. This includes removing networks (such as the Corvus Multiplexer and OMNINET local networks) and backup devices (such as the Corvus Mirror). Using a known good Interface PCA and flat cable, connect the Corvus disk drive to a known good host computer.

Before any diagnosis of the Corvus disk drive can be carried out, the symptom must be duplicated. If the problem does not reoccur within a reasonable amount of time, run the Burn-In diagnostic program overnight to thoroughly test the drive.

8.5.3 Drive Not READY

In order to utilize the diagnostic software provided, the Corvus disk drive must first be in the READY condition, indicated by the READY LED being lit. Power on the drive and wait approximately 90 seconds. The BUSY and FAULT LEDs will light during power-up but go out. The READY LED alone should be lit, and if this does not occur, steps must be taken to correct it.

8.5.3.1 Interface

The host computer Interface PCA or cable could be defective, not allowing the drive to reach the READY condition. Disconnecting the flatcable from the drive PROCESSOR connector will isolate the drive. If the READY LED now lights, replace the Interface PCA and cable, one at a time, to isolate the faulty module.

8.5.3.2 Controller Firmware

During the normal power-on sequence Controller Firmware is read into the controller RAM. If the Controller Firmware has been disrupted or contains bad blocks, the drive will not be READY after the power-on sequence completes.

To determine if this is the cause of the symptom, turn on the FORMAT switch and toggle the RESET switch. This will reset the Z-80 Controller, and if the drive passes the hardware self-test, will ignore the Controller Firmware. If the READY LED now lights, faulty Controller Firmware is indicated and the UPDATE utility (Chapter 7) must be executed to rewrite the Controller Firmware code. After this has been done, turn off the FORMAT switch and toggle the RESET switch. This again will reset the Z-80 controller which will read the newly-written Controller Firmware into the on-board RAM. The READY LED should now light.

8.5.3.3 Power Supply Voltages

If the fault has been determined to be a drive hardware failure, the first action taken should be to check the power supply voltages.

Check the voltages when the drive is first recieved, and because of line voltage variations between locations, at the customer site also. If any of the dc output voltages cannot be brought within tolerance, the power supply must be replaced.

Using a Digital Voltmeter, follow the voltage check and adjustment procedures outlined in the Adjustments section of this manual. The dc power connectors (located on the PCA(s) underneath the sealed mechanism and on the backplane) should be checked for a clean and tight fit. Measuring the voltages at the drive Backplane power pins as well as at the power supply will verify that the power connector and cable are in good condition. Inspect the dc power cable, checking for breaks at both ends. The power cable may be faulty if the voltages are not present at the drive Backplane.

Symptoms indicating power supply failure or misadjustment include front bezel LEDs failing to light, drive motor failing to turn or speed fluctuating, and drive going off-line (drive error 255), and CRC errors.

The output of the power supply is a function of the correct ac input; the dc voltages will not be correct if the improper line voltage is selected. To verify that the proper line voltage has been selected, locate the CORCOM unit on the rear bezel of the drive cabinet. This unit contains the fuse and voltage selection PCA. If the voltage is changed, be sure that the line fuse is also changed. Symptoms indicating incorrect line voltage selection include dim or dark LEDs, low motor speed, and extreme heat output.

8.5.3.4 Drive Electronics

If the READY LED will not light, and the power supply is operating properly and the voltages are within tolerance, it is probably due to a faulty component within the drive.

Sometimes symptoms indicating a faulty drive PCA are in fact caused by poor contact between connectors. Power supply connectors, PCA edge connectors, IC sockets and switch contacts are some of the connectors which may lose contact, and result in a malfunctioning drive. Reseating all connectors and using an eraser, clean on all gold edge connector pins to help eliminate any oxidation that may have built up, causing improper contact. Also, reseating socketed ICs on the drive Controller PCA will ensure good pin connections. Toggling all switches (front bezel, rear bezel MIRROR switches, Controller address switches) will insure a clean switch contact.

WARNING:

Always turn off ac power and disconnect power cord before replacing any components.

If the problem still persists, replace the drive controller with a known good unit:

1. Remove power to the drive.
2. Disassemble the drive (chapter 6) and remove the Controller PCA.
3. Install a known good Controller PCA.
4. Power on the drive.

If the controller was faulty, the READY LED will now light. If the READY LED still fails to light, the next step is to replace the drive sealed mechanism with a known good unit.

8.5.3.5 Drive Sealed Mechanism

The drive mechanism is a sealed unit with no field-serviceable parts. Any malfunction of the drive mechanism, or associated Read/ Write PCA and Logic PCA, necessitates replacing the entire drive module.

Drive mechanism failure may be due to any one of the following:

1. Microchip failure
2. Drive motor failure
3. Servo-stepper motor failure

8.5.4 Link Inoperative

If the drive powers on, spins up to speed, passes the self-test and the READY LED lights, certain basic circuits and sub-systems within the drive are working. The test does not, however, verify the integrity of the Disk Operating System (DOS), the disk media or the drive electronics and power supply. If the DOS is damaged or not properly patched for communication to the Corvus disk drive (initialization procedures, Corvus User Guide), the drive will not function properly.

Linking is the process of booting the host computer with the Corvus-patched DOS. The type of DOS depends on the type of computer system, and should be a known good copy, patched for the Corvus drive. For those systems that do not store a DOS image on the Corvus drive and then boot directly from the Corvus (CP/M does not), booting the standard floppy-based DOS and executing the LINK program will establish the patch.

Corvus recommends that Corvus Dealer Service Centers keep on hand archival, known good Corvus-patched copies of the DOS for the specific computers serviced at that location. This will insure that a new DOS copy may be substituted for the users' DOS for troubleshooting purposes.

8.5.4.1 Check Link Action

Boot the computer using a known good boot image or link software. When this has been done, list the directory of the drive or volume. If this fails or a drive error is returned, steps must be taken to correct this.

8.5.4.2 Power Supply

The power supply voltages should be checked and adjusted if necessary before any further testing is done. Without proper voltages, the read amplifier on the Read/Write PCA will be referencing incorrect thresholds for the data signal, possibly mistaking a good sector for a CRC error.

8.5.4.3 CRC Test

Execute the CRC test. This will test the controller's ability to decode drive commands, as well as the stepper motor and read-write electronics. This test will also verify the condition of the drive media. The CRC test will report either no errors or the cylinder, head and sector numbers of the faulty sector. If the CRC errors are encountered, the complete track must be spared (PRM option, drive Diagnostics, Corvus User Guide).

Sometimes the CRC test will not begin (READY LED remains lit) or will not finish (BUSY LED flickers momentarily, and then the READY LED alone lights). A misadjusted power supply or improper format could cause this. Also, a damaged copy of the CRC program could cause problems, making it impossible to trace problems without a known good copy of the utilities.

8.5.4.4 Controller Communication

If the drive does not respond to the CRC test, this may be due to several causes. First, some simple oversight may be the cause (see On-Site Checks, section 8.5.1). Alternately, the controller may not be properly decoding the commands sent from the Host Computer (due to incomplete Controller Firmware resident in RAM, or to a defective component on the Controller PCA), or the drive mechanism itself may have a defective component.

Executing the Controller Diagnostic DOWNLOAD command will attempt to establish communication with the Controller PCA. The diagnostic software will respond with "Programs Loaded To Controller Memory" if this succeeds. Further diagnostic commands should then be executed to determine if the controller is communicating with the drive mechanism. If the diagnostic DOWNLOAD command responds with "Download Aborted" this indicates that the Host Computer and the Controller PCA are not communicating. This could be due to several causes: improper switch selection (FORMAT, MUX, LSI switches, MIRROR switches, Controller PCA switches); defective Interface PCA or cable; defective Controller PCA; defective diagnostic software or incorrect power supply voltages.

8.5.4.5 Servo Action

Once communication with the Controller PCA has been established, drive mechanism performance should be checked. Executing the servo exercise command (Controller Diagnostic LOOPSEEK command) will verify the drive mechanism's ability to seek and read. Fatal errors encountered during this diagnostic command indicate a possible defective drive mechanism.

8.5.4.6 Controller Firmware

If the controller and drive mechanism respond positively at this point, the Controller Firmware should be rewritten and the drive parameters checked (drive Diagnostic utility PARAM) if this has not been done already. The Z-80 controller does not check each block in the Controller Firmware area to check that it is legitimate Controller Firmware code, and will attempt to load it into the on-board RAM and execute it, when the drive is powered on. If the READY LED lights after power-on, this is only an indication that no CRC errors have been encountered. Rewriting firmware is non-destructive to data.

8.5.4.7 Boot ROM

Some computer systems use an auto-boot ROM on the Interface PCA to boot a DOS image from the boot area of the drive. A faulty memory location in this ROM may cause the drive to fail at boot time. Replace only with a tested, known good replacement.

8.5.4.8 Interface Components

A defective Interface PCA or cable may be the cause of problems with the drive. Replace both, only with tested, known good replacements. If the drive works, reinstall the originals one at a time, retesting the drive after each, in order to isolate the particlar faulty component.

8.5.4.9 Drive Initialization

Drive initialization (separate from drive format) sets up the disk storage for data and code files used by the host computer system. A boot image, containing the operating system of the host computer system, may also be stored on the drive. Random write commands may corrupt these disk areas, and cause unpredictable data access. Drive format, however, defines the structure of the sector, writing sector information relevant to the controller (sector number, CRC value, etc.). Uncoordinated flux transitions on the disk media may corrupt not only the data, but the sector as well, terminating its ability to retain data.

Corvus provides drive initialization software for each computer operating system (CP/M™, Apple DOS™, UCSD Pascal™, NEWDOS™, IBMDOS™, CCOS™, etc). These utilities initialize the platter surface for accepting a DOS boot image (where applicable) as well as directory and data area.

These areas of the disk, if disturbed either physically or magnetically, will no longer retain the correct information sought by the CATALOG or DIRECTORY listing commands. In this case, the initilization procedures (i.e. PUTGET, PSYSGEN or BSYSGEN) must again be executed to properly initialize the disk surface (refer to the Corvus User Guide for initialization procedures). Since initializing disk directories is DESTRUCTIVE to data, a current backup of the drive data should be kept. Also, be sure to use archival, known good copies of all software whenever initializing the drive.

Any problems persisting at this point lie either with the drive electronics or the disk media. The electronics should be tested, and if the cause of the problem is not found here, the drive should be reinitialized, using a new copy of the software utilities.

8.6 Final Adjustments and Tests

When the faulty module in the drive has been replaced and the problem eliminated, the repair process is only half completed. Final checks and adjustments must be made and the drive tested thoroughly overnight before it may be returned to the user.

8.6.1 CRC Test

The drive media must be verified reliable before the drive can be certified as usable. The CRC test should be executed before and after the drive image is restored (using the Mirror) to check that no sectors have been destroyed. Tracks with faulty sectors should be spared using the PARAM option of the drive Diagnostics.

8.6.2 Install and Test Mirror

If a Corvus Mirror back-up device was part of the original disk system, it should have been removed from the system as one of the first steps in troubleshooting the drive. Having traced and replaced the faulty component in the drive, the Mirror should now be installed and tested. (Refer to the Corvus Mirror Service Manual for procedures on troubleshooting and servicing the Mirror).

8.6.3 CRC Test

Executing the CRC test once again, verifies that elementary communication exists, and that no sectors were accidentally destroyed by restoring a faulty Mirror image.

8.6.4 Power Supply

After troubleshooting procedures have been completed, the power supply voltages must be checked once again before the drive can be tested. This is to insure that the Burn-In test is testing a properly adjusted drive.

8.6.5 Burn-In Test

The Burn-In test is the final endurance test of the drive, revealing any malfunctions as hard or soft errors. This program tests the seeking, reading and writing abilities of all drives connected to the host computer.

The Burn-In test should be run, at a minimum, overnight after all repairs and adjustments on the drive have been completed. If any sectors experience persistant CRC errors, the tracks should be spared (Drive Diagnostic utility PARAM).

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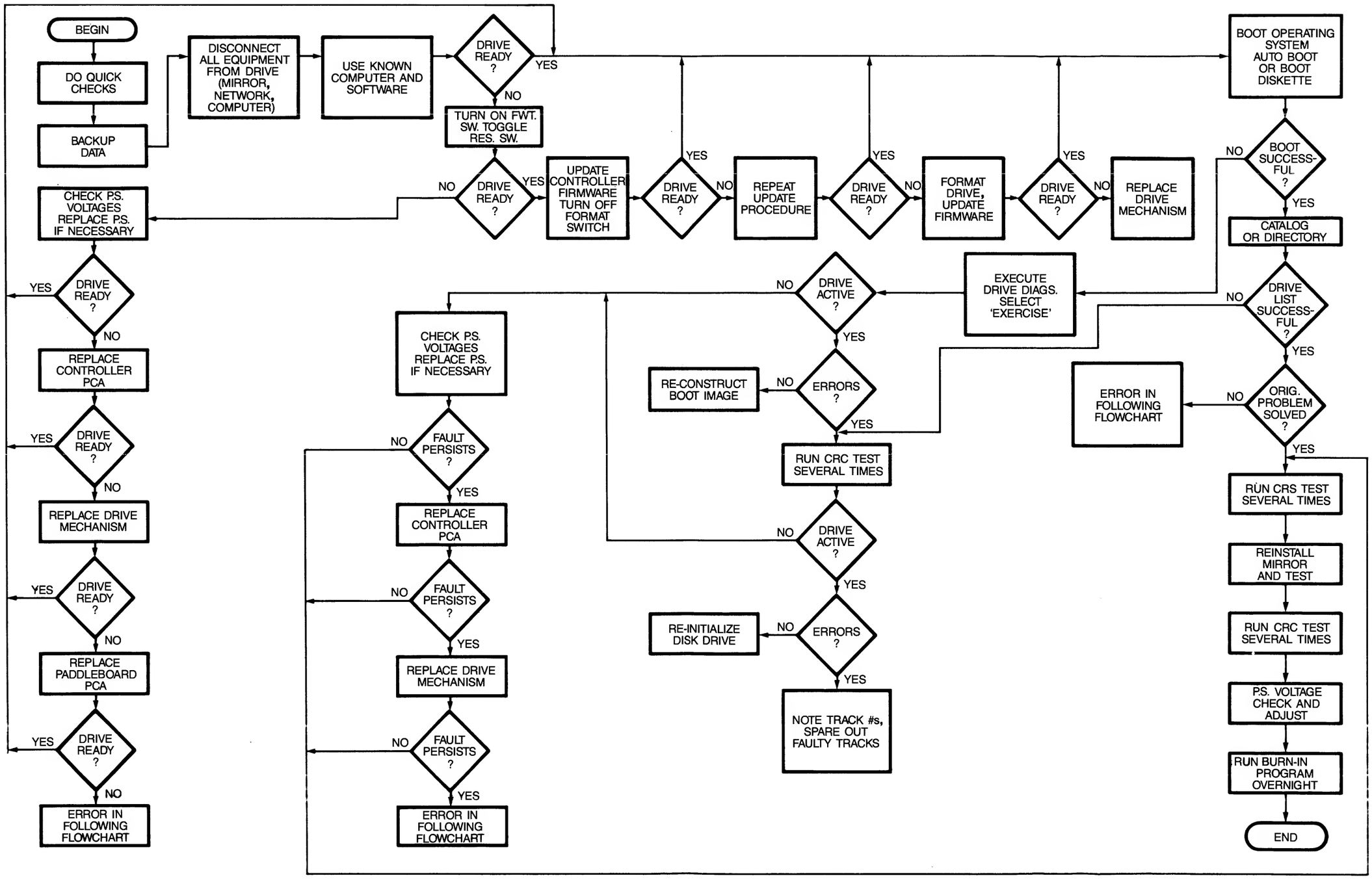
TROUBLESHOOTING FLOW CHART



SYMPTOM	CAUSES	RECOMMENDED REPAIR
1. Drive platters won't turn.		
A. All LEDs off and stay off.	ac power improperly selected.	Check and adjust.
	+12V misadjusted	Check voltage and adjust.
	+12V not present at drive mechanism	Check dc power connector for continuity and proper connection at drive
	+12V not existent or not adjustable	Replace power supply
B. All LEDs light then BUSY alone remains lit	Brake solenoid not releasing	Adjust brake mechanism
	Drive motor defective	Replace drive sealed mechanism
2. Unable to format drive		
A. READY remains lit	Mirror switches set wrong	Check and set properly
	Interface card defective	Replace interface card
	Interface cable defective	Replace interface cable
	Controller ROMs defective	Replace Controller ROM
	Controller PCB defective	Replace Controller PCB
	Backplane defective	Replace backplane
B. BUSY remains lit constantly	Controller unit address switches set incorrectly	Set switches correctly
	Controller ROMs defective	Replace Controller ROM
	Controller PCA defective	Replace Controller PCA
	Drive mechanism defective	Replace drive mechanism
3. Unable to update Controller firmware		
A. All LEDs go off, remain off	Drive not ready.	Turn on FORMAT switch, toggle RESET switch
	Bad track in firmware area HDA	Replace drive sealed mechanism
	Controller PCA defective	Replace Controller PCA
	Drive sealed mechanism defective	Replace drive sealed mechansim
B. Busy LED lights and remains lit	Drive format blown	Reformat drive
	Controller ROMs defective	Replace Controller ROM
	Controller PCA defective	Replace Controller PCA
	Drive sealed mechanism defective	Replace drive mechanism

SYMPTOM	CAUSES	RECOMMENDED REPAIR
4. CRC FORMAT CHECK will not begin or finish		
A. Busy LED lights and remains lit, or FAULT LED only remains lit	Front bezel switches incorrect	Check switch settings
	Controller ROMs defective	Replace Controller ROMs
	Format not intact	Reformat drive
	Controller PCA defective	Replace Controller
	Drive sealed mechanism defective	Replace drive mechanism
5. Unable to spare track		
A. All LEDs off and remain off	Controller ROMs defective	Replace Controller ROM
	Controller PCA defective	Replace Controller PCA
	Drive sealed mechanism defective	Replace drive mechanism
	Maximum number of tracks already spared (7 total)	Replace drive mechanism
6. Drive will not execute Servo Exercise under Diagnostic		
A. Busy LED remains lit	Power supply voltages misadjusted	Check voltages, adjust or replace supply as needed
	Drive sealed mechanism defective	Replace drive mechanism
7. Computer boots into monitor (Apple)		
A. Drive goes BUSY, then READY	Boot image corrupted	Recreate boot image (see Corvus user guide)
	Boot program on Corvus utility diskette corrupt	Recreate boot image using good copy of utilities
	Boot ROM on interface PCA bad	Replace Boot ROM
	Interface PCA defective	Replace Interface PCA
8. Drive will not Boot		
A. Busy LED lights and remains lit	Drive does not contain boot image	Create boot image on drive (see user's manual
	Boot ROM on interface PCA defective	Replace Boot ROM
	Interface PCA defective	Replace Interface PCA

SYMPTOM	CAUSES	RECOMMENDED REPAIR
	Controller ROMs defective	Replace Controller ROM
	Controller PCA defective	Replace Controller PCA
	Drive sealed mechanism defective	Replace drive mechanism
B. READY light remains lit	Mirror switches set incorrectly	Set switches properly
	Front panel switches set incorrectly	Set switches correctly
	Interface board defective	Replace interface board
	Interface cable defective	Replace interface cable
9. I/O errors during normal operation		
A. Normal LED display or all LEDs off and remain off	Software currently running on host system defective	Replace software with known good copy and reexecute
	Boot image corrupted	Recreate boot image (see user's manual)
	Defective track	Execute CRC FORMAT CHECK. Spare any tracks returning errors
	Controller ROMs defective	Replace Controller ROM
	Controller PCA defective	Replace Controller PCA
	Power supply voltages out of tolerance	Adjust power supply
	Power supply voltages fluctuating	Replace power supply
	Drive sealed mechanism defective	Replace drive mechanism
10. Heads slam against inner crash stop (toward hub)		
A. Busy LED lights and remains lit	Controller Firmware corrupted	Update Controller Firmware
	Power supply voltages out of tolerance	Check voltages, adjust if necessary
	Power supply voltages intermittant or can't adjust	Replace supply
	Controller ROMs defective	Replace Controller ROM
	Controller PCA defective	Replace Controller PCA
	Drive sealed mechanism defective	Replace drive mechanism
11. Sector destroyed during normal operation		
A. Busy LED lights and remains lit	Boot ROM (where applicable) or interface board defective	Replace boot ROM. If problem persists, replace Interface PCA

SYMPTOM	CAUSES	RECOMMENDED REPAIR
	ac power surge during read/write operation	Determine quality of ac power supplied to Corvus and host. Determine types of devices on same ac circuit. Large power consuming devices should not share power with the disk drive.
	Power supply voltages out of tolerance	Check and adjust voltages
	Controller PCA defective	Replace Controller PCA
	Weak media spot on platter surface	Determine tracks affected and spare
	Defective drive sealed mechanism	Replace drive mechanism
12. Motor speed varies	+12V out of tolerance	Check and adjust voltage
	dc cable to drive defective	Check wiring, replace supply if bad
	Loose dc connection at drive	Clean connector pins, make sure connector is seated properly
	+12 V non-existent or not adjustable	Replace power supply
	Drive motor defective	Replace drive sealed mechanism
13. Low motor speed	ac input voltage set incorrectly	Check and adjust
	See #12. above	
14. Heads do not rezero		
A. BUSY LED lights and remains lit	Firmware corrupted	Update firmware
	Format corrupted	Reformat drive and update firmware
	Low motor speed	See #12 and 13 above
	Controller unit address set wrong	Set switches correctly
	Controller PCA defective	Replace Contoller PCA
	Drive sealed mechansim defective	Replace drive mechanism
B. FAULT and BUSY LEDs stay on, READY goes off	Controller ROMs defective	Replace Controller ROM
	Controller RAM defective	Replace 4118 RAM on Controller PCA
	Controller PCA defective	Replace Controller PCA
C. All LEDs stay off	Incorrect ac power setting	Check and adjust
	Power supply voltages incorrect	Adjust or replace supply as necessary
	Defective Controller ROMs	Replace Controller ROM
	Defective Controller PCA	Replace Controller PCA

SYMPTOM	CAUSES	RECOMMENDED REPAIR
	Paddleboard cable connected wrong	Check paddleboard cable connections
	Defective paddleboard	Replace paddleboard
	Defective paddleboard cable	Replace cable
	Defective drive sealed mechanism	Replace drive mechanism
	Defective backplane	Replace backplane
D. All LEDs stay on	Power supply voltages incorrect	Adjust or replace supply as necessary
	Defective Controller PCA	Replace Controller PCA
	Defective drive sealed mechanism	Replace drive mechanism
15. Head oscillates after drive is turned on		
A. BUSY LED lights and remains on	Controller Firmware corrupted	Update firmware
	Format corrupted	Reformat and update firmware
	Power supply voltages incorrect	Adjust power supply
	Power supply defective	Replace power supply
	Controller PCA defective	Replace Controller PCA
	Drive sealed mechanism defective	Replace drive mechanism

APPENDIX A
GLOSSARY

GLOSSARY

BACKPLANE OR MOTHERBOARD: two-slot printed circuit board which accepts the Mirror PCA (when installed) and Controller PCA.

BIT: single binary digit. Smallest representative unit of data, several of which make up characters (A-Z, 0-9, etc.). Bits may be either a one or a zero, on or off, set or reset. This may be shown by either a signal being present or not, or by a signal changing states or being constant.

BLOCK: a relative quantity of data bytes. The Corvus disk defines one block to contain 512 bytes of data, the smallest addressable unit within the drive. The host operating system may define a block as 128, 256 or 512 bytes in length. Externally, since the disk drive handles data in sectors, no apparent conflict appears to the host system.

BRAKE OR SOLENOID BRAKE: immediately after power-down, this mechanism engages, so as to minimize contact time between heads and disk surface, and brings the platters to a stop.

BYTE: any multi-bit digital value, usually eight bits long. The Corvus disk drives use eight-bit bytes.

CABINET OR ENCLOSURE: the cabinet which contains the IMI drive mechanism, power supply and fan. The front bezel attaches to the cabinet basepan. Two screws at the rear of the cabinet secure the cabinet top to the basepan.

CONTROLLER OR Z-80 CONTROLLER OR INTELLIGENT CONTROLLER: the disk controller circuitry including the Z-80 microprocessor and support logic.

CORCOM: the rear bezel unit which accepts the power cord, and contains the line filter, line voltage PCB and fuse.

CYLINDER: all data tracks in common vertical alignment. There are 306 concentric cylinders on all H-series drives. The Model 6 has two tracks per cylinder, the Model 11 has four, and the Model 20 has 6.

DISK MECHANISM OR SEALED MECHANISM: the IMI disk drive assembly consisting of platters, drive motor, head assembly and stepper-motor mechanism, all in a sealed, cast aluminum body. The above components inside the sealed mechanism are not field-servicable and the unit is not to be opened by any other than a Corvus factory facility, otherwise the warranty will be void.

DMA OR DIRECT MEMORY ACCESS: method by which data is transferred at a very high rate, independent of the processor. The processor is put into a "wait" state, where it does no data manipulation. The DMA circuitry takes care of all details, using the Z-80 address bus for destination or origin address for data transfer.

DVM: Digital Volt Meter. A meter used for measuring voltages, which shows output by means of a display consisting of changing digits, proportional to the voltage measured.

FIRMWARE or CONTROLLER FIRMWARE: Z-80 code contained in the first two cylinders of the drive consisting of routines for the Spare Track Table, Virtual Drive Offset table, Pipes, and Semaphore Status Flags. The appropriate routines are downloaded from the Firmware into the on-board RAM for execution by the Z-80 Controller at power-on time.

FRONT BEZEL: the front panel of the cabinet, containing the Paddleboard PCA and logo.

GROUNDSTRAP: located at the lower end of the spindle in the drive sealed mechanism, the groundstrap consists of a copper metal strip terminating with a carbon button which rides on the spindle end. This device discharges any static charge which may build up on the platters or spindle.

HEAD: in the Winchester disk, very low-mass glass-ferrite, aerodynamic-shaped component, containing a wire winding. There is one head for each data surface which float 18 microinches above the platters on a cushion of air. When current passes through the winding, an electromagnetic flux is induced into the platter surface representing a bit.

HEADSTACK: casting to which all heads are attached. Located in the top of the headstack is the microchip responsible for head selection and signal buffering.

IC: Integrated Circuit. A hybrid, densely populated wafer of silicon containing many resistors and transistors.

MEGABYTE: one million bytes.

MFM (MODIFIED FREQUENCY MODULATION): a method of writing information on a magnetic surface which allows a higher bit density to be used, therefore increasing storage capacity while decreasing size.

MOTOR CONTROL PCA: printed circuit board responsible for monitoring the spindle motor speed and adjusting this as necessary.

NRZ (NON-RETURN TO ZERO): digital representation of information used by microprocessors.

PADDLEBOARD: the small PCA located on the front bezel, which contains the three LEDs and four function switches.

PCA: Printed Circuit Assembly. The Printed Circuit Board, assembled with all its components.

PCB: Printed Circuit Board. Epoxy board with a copper circuit etched onto it. The PCB is the bare board without the usual components such as resistors, transistors and integrated circuits.

PLATTER: circular disks coated with a magnetic oxide that will retain a magnetic flux induced by the read/write heads. Both surfaces of each platter contain data. The 10-megabyte drive has two platters, while the 20-megabyte has three.

REAR BEZEL: the rear most panel area of the cabinet, containing the flatcable connectors for the interface cable, video connectors, power cable and fuse holder. Serial number is located on the rear bezel, also.

SECTOR: each track is divided radially into 20 segments. Each segment is one sector, and contains one block of data, one CRC value, and header information required by the disk controller.

SINUSOIDAL WAVE: a wave form that represents periodic oscillations.

TRACK: all points on one surface with the same radius. Tracks are configured concentrically on each surface.

WINCHESTER TECHNOLOGY: a unique design first developed by IBM as a means to reduce the size of a disk drive while increasing its capacity and removing the posibility of contamination of the disk components. The result was a disk unit much smaller than the traditional 14-inch disk platters with equivalent capacity. This is due to new head design and the use of the sealed-environment used with the disk drive which does not allow the external atmosphere inside the disk mechanism. Inherent in this design is heads that rest on the platters after the drive is powered off. The Corvus disk system uses International Memories Incorporated (IMI) Winchester disk drives.

READ/WRITE PCA: the printed circuit assembly responsible for changing the data received from the heads in MFM format and amplifying and shaping the data signal before passing it on to the Controller circuitry for manipulation.

APPENDIX B
PARTS LIST FOR B-SERIES 6MB DRIVES

APPENDIX B
PARTS LIST FOR B-SERIES 6MB DRIVES

PART NUMBER	DESCRIPTION
2200-01669	6MB DRIVE MECHANISM (REV B - E)
2200-01668	CONTROLLER PCA (REV B - E)
3100-02072	TOP COVER ONLY, REV D, E (GREY PLASTIC)
3100-02073	BOTTOM PAN ONLY, REV E (GREY PLASTIC)
8010-08109	FRONT BEZEL, REV A, B
3100-0271	FRONT BEZEL, REV D, E
2400-01527	DRIVE SUPPORT BRACKET/SHIELD, REV C - E
2600-01143	FAN, REV A, B
2600-01145	FAN, REV C - E
2600-04138	AC CORD FOR FAN, REV A, B
6000-01438	AC CORD FOR FAN, REV C - E
3010-08026	PCA MIRROR
4000-01667	CP134 POWER SUPPLY, REV A
8010-08629	HB5 POWER SUPPLY, REV A
8010-08060	CP417 POWER SUPPLY, REV B - E
6010-01447	AC LINE CORD
8010-08029	PADDLEBOARD PCA
8010-08040	FLATCABLE, PADDLEBOARD - BACKPLANE
8010-08042	FLATCABLE, INTERFACE (5FT)
8010-08108	BACKPLANE PCA, ASSEMBLY
8010-08063	DC HARNESS
8010-08050	AC HARNESS (POWER SWITCH, CORCOM)

APPENDIX C
B-SERIES 6-MEGABYTE CABLING CHART

APPENDIX C
B-SERIES 6-MEGABYTE CABLING CHART

The following references of "left" and "right" are as seen from the front of the fully assembled drive cabinet.

REVISION A DRIVE

Flatcables:
- —Mechanism-to-backplane (34-pin)
  - Mechanism: one-edge forward
  - Backplane: one-edge to the left
- —Paddleboard-to-backplane (34-pin)
  - Paddleboard: one-edge down
  - Backplane: one-edge to the left
- —Backplane-to-host interface (34-pin)
  - Backplane: one-edge to the left
  - Host interface: refer to the Installation Guide

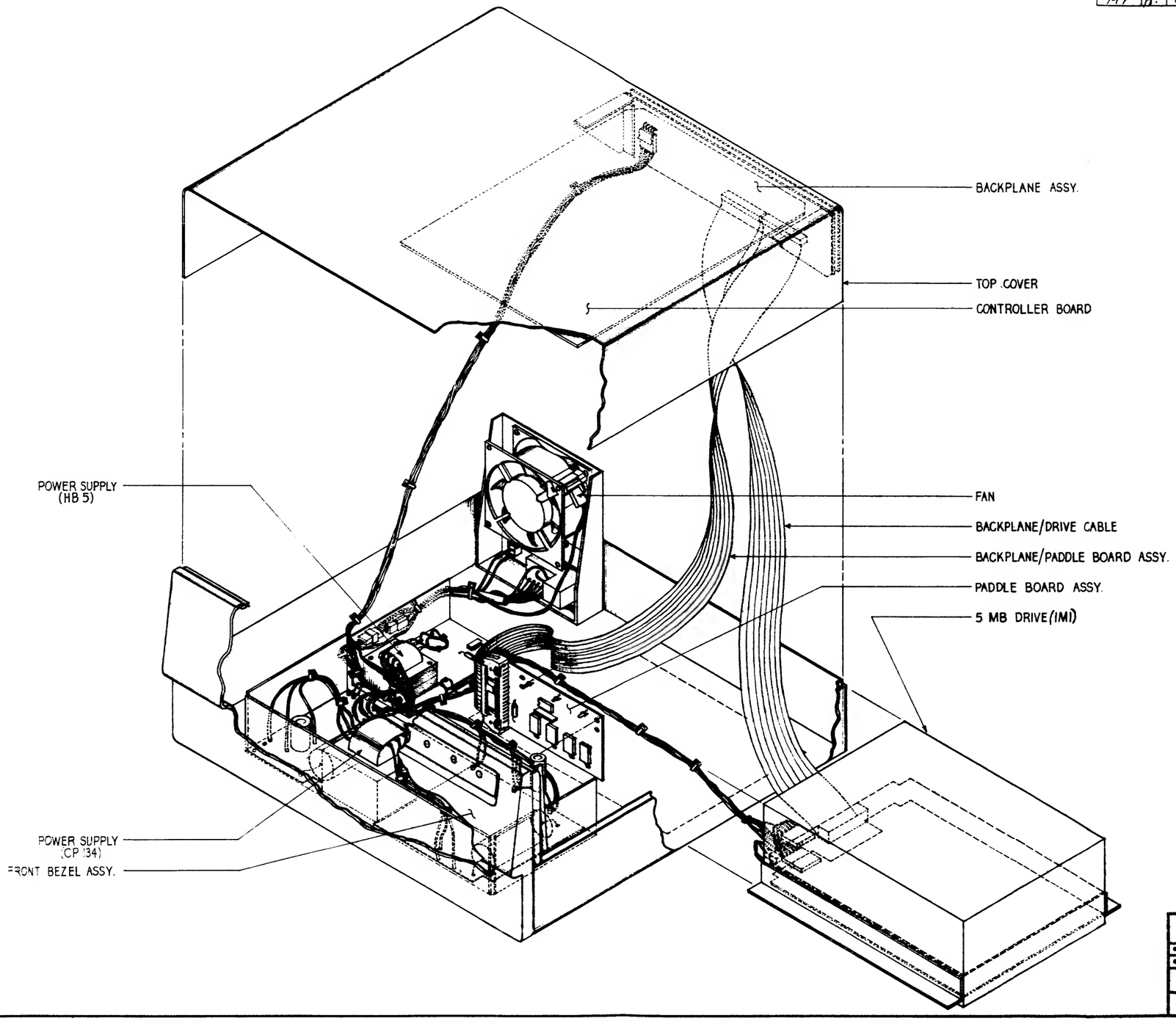
Dc Power Cables:
- —Drive mechanism (4-wire):
  - Black wire forward
- —To Backplane (5-wire):
  - Red wire to the left

REVISION B - E DRIVES

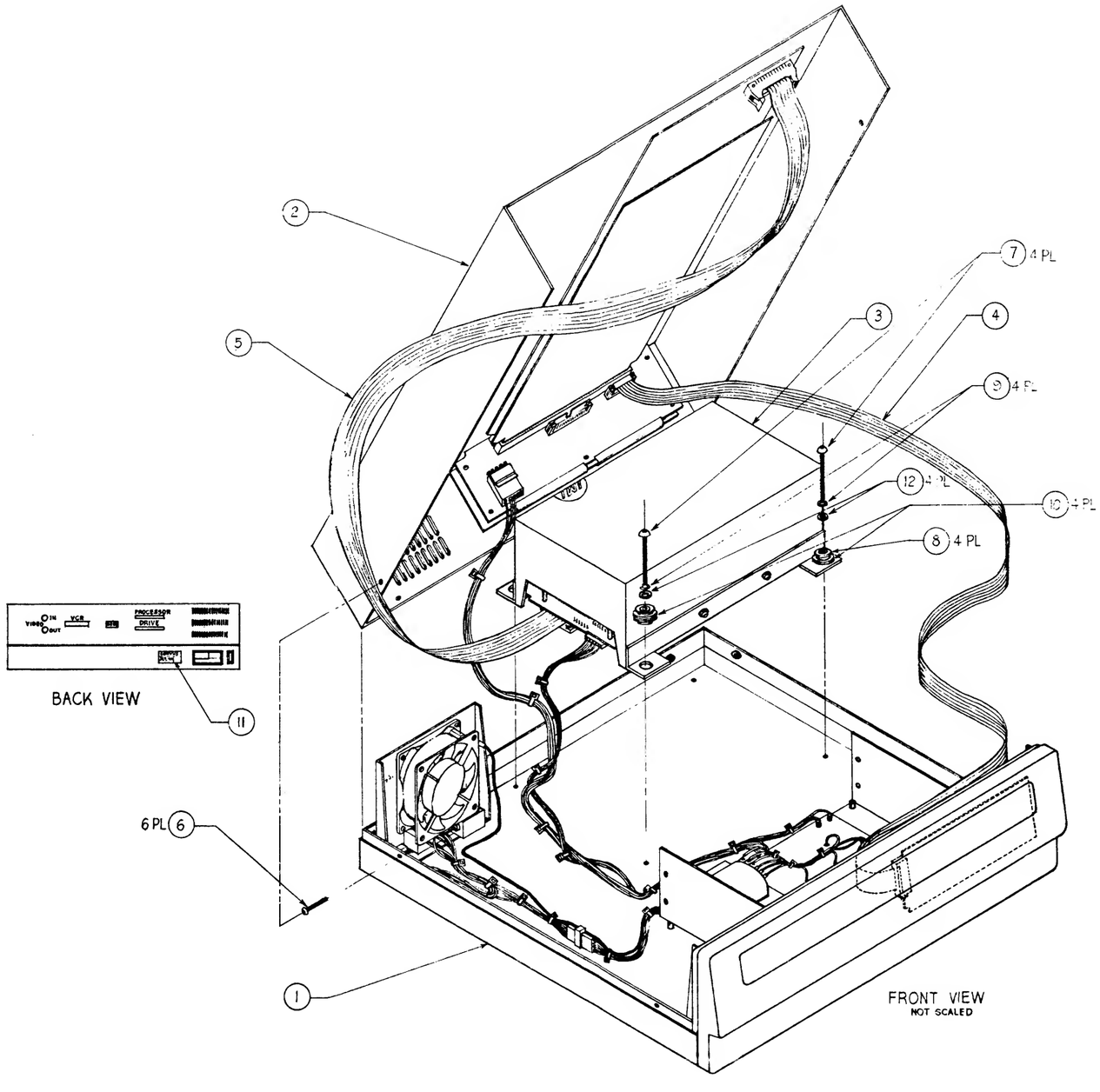
Flatcables:
- —Mechanism-to-controller (26-pin)
  - Mechanism: one-edge to the rear
  - Controller: one-edge to the left
- —Paddleboard-to-backplane (20-pin)
  - Paddleboard: one-edge down
  - Backplane: one-edge to the left
- —Backplane-to-host interface (34-pin)
  - Backplane: one-edge to the left
  - Host interface: refer to the Installation Guide

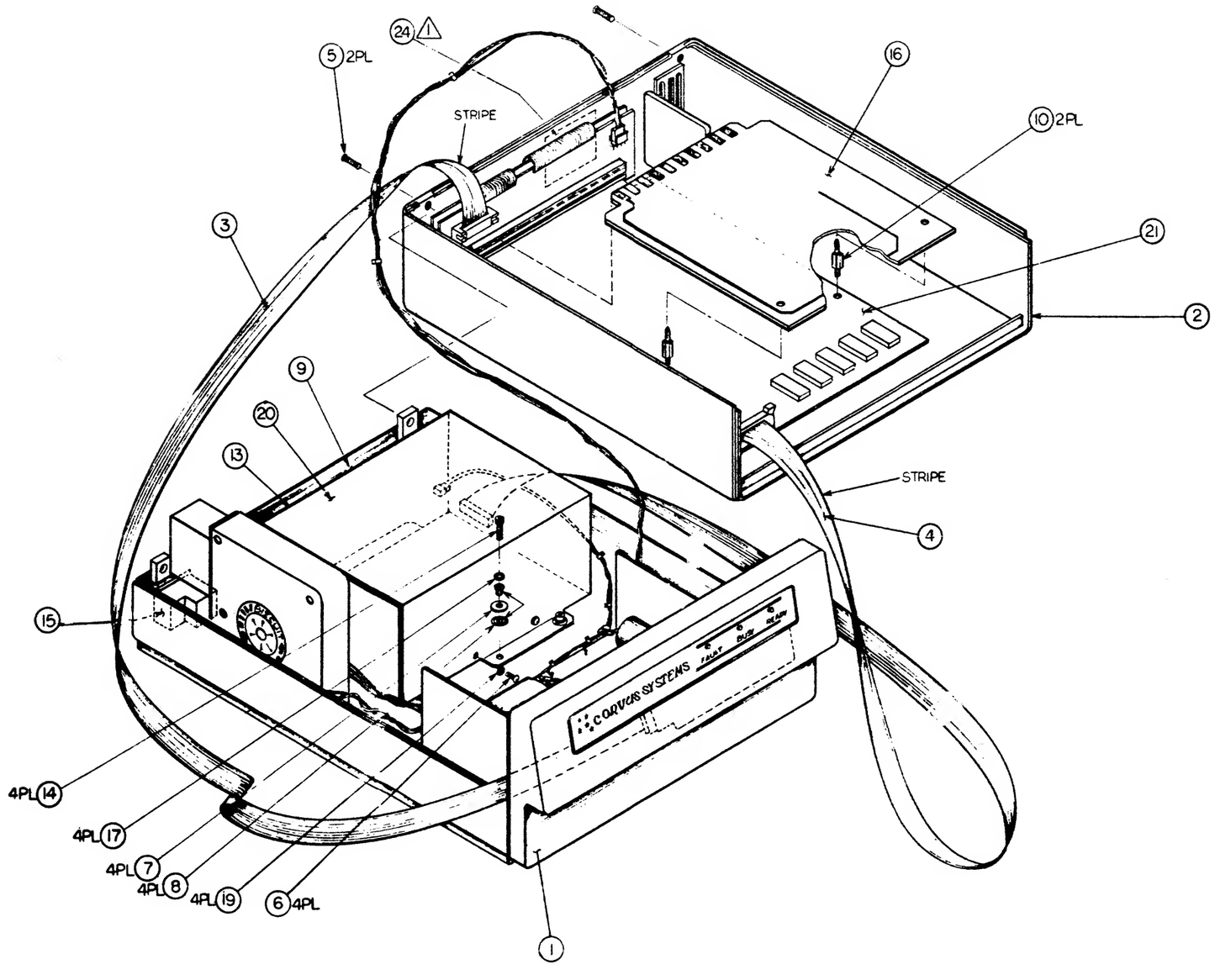
Dc Power Cables:
- —Drive mechanism (5-wire):
  - Red wire forward

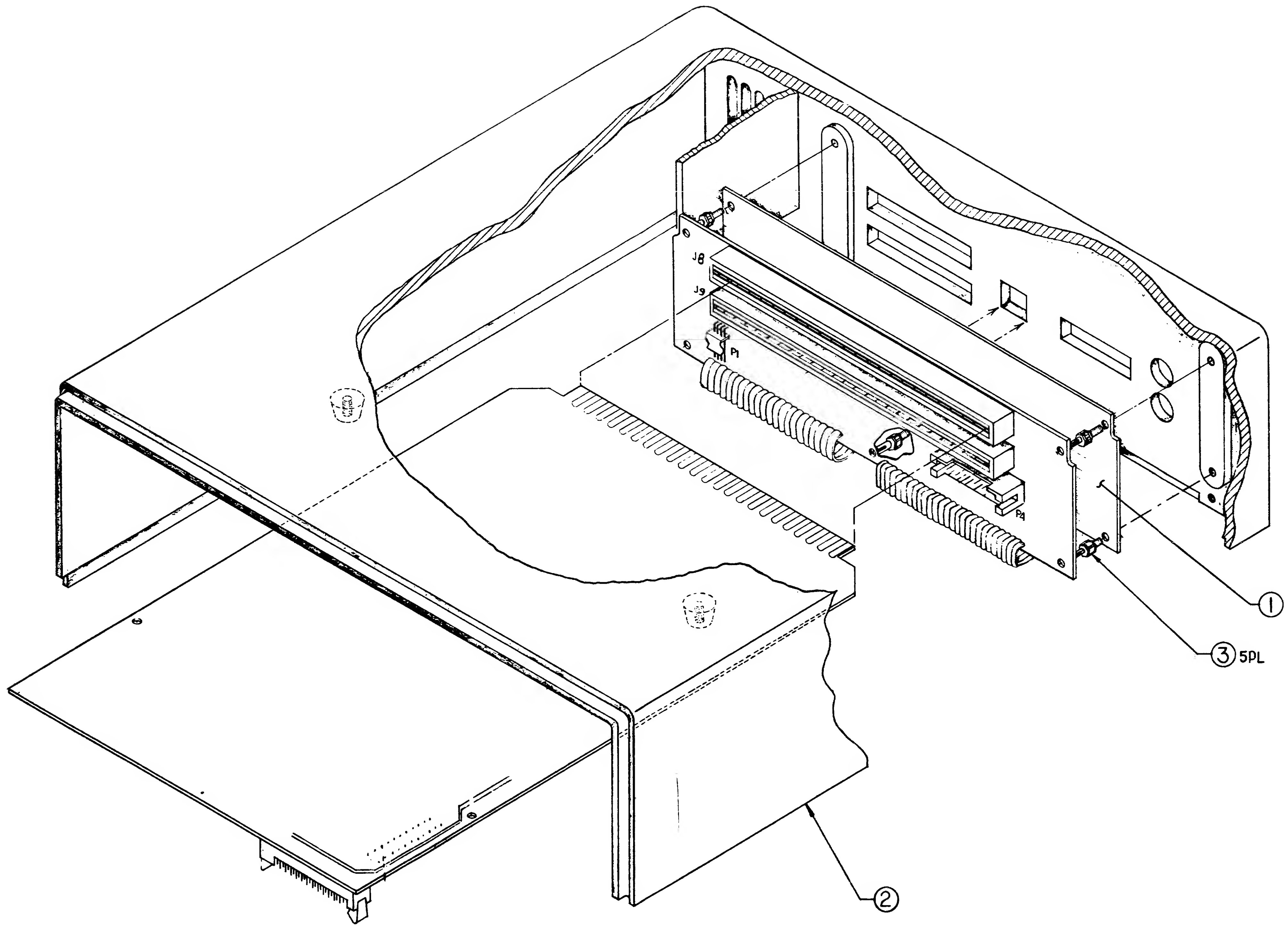
REVISION				
PCO NO	REV	DESCRIPTION	APPROVED	DATE
147	A.	REL FOR PROD	[signature]	7-2-81



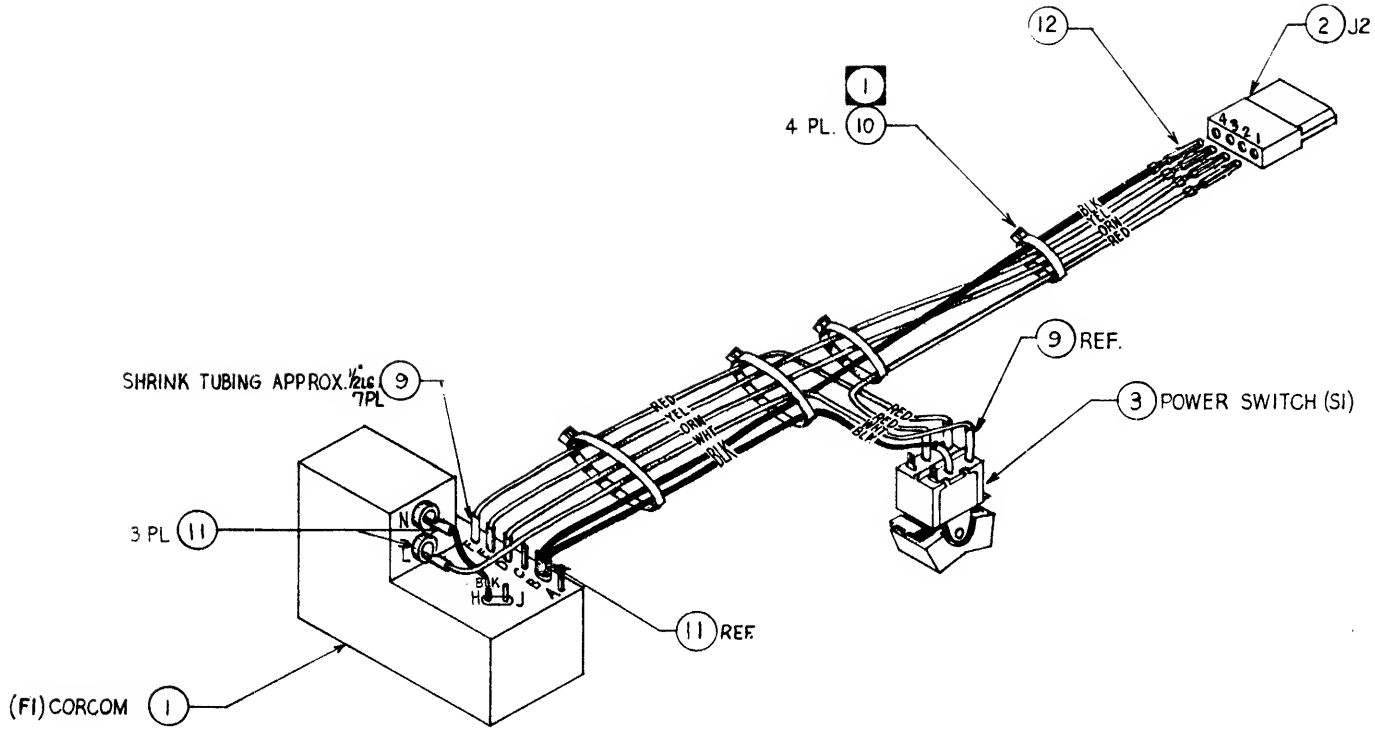
CORVUS SYSTEMS, INC.		
SCALE NONE	DRAWN 6-30-81 [signature]	BOARD A
6 MB TOP ASSY. PHASE I		
ASSY. DRAWING		8000-08009


2
5
7 4 PL
3
4
9 4 PL
12 4 PL
10 4 PL
8 4 PL
6 PL 6
1
11
VIDEO IN
VIDEO OUT
VCR
PROCESSOR DRIVE
BACK VIEW
FRONT VIEW
NOT SCALED


24 ⚠
5 2PL
STRIPE
16
10 2PL
21
3
2
9
20
13
STRIPE
4
15
CORVUS SYSTEMS
4PL 14
4PL 17
4PL 7
4PL 8
4PL 19
6 4PL
1


J8
J9
P1
P4
1
3 5PL
2

APPENDIX D
ASSEMBLY AND SCHEMATIC DRAWINGS



NOTE: UNLESS OTHERWISE SPECIFIED.

1. SHOWN OPEN TIE WRAPS FOR CLARITY ONLY. WRAPS SHOULD BE PULLED TIGHTLY.

Microcomputer Power, Inc.

2272 Calle de Luna, Santa Clara, CA 95050

(408) 988-0265 TWX 910 338-7694

APPLICATION DATA INCLUDING:
1. SCHEMATIC
2. PARTS LIST
3. SPECIFICATION
4. OUTLINE & MOUNTING DRAWING

MODEL
CP134

MICRO/DISK SERIES

SPECIFICATIONS:

AC INPUT: 115/230VAC ±10%
47-63Hz

DC OUTPUT:

VOLTAGE	CURRENT(AMPS)
5	6.0
12	3.4
-12 OR* -5	0.5 OR* 0.25

*JUMPER SELECTABLE ON P.C.BOARD

LINE REGULATION: ±.05% FOR A 10% LINE CHANGE

LOAD REGULATION: ±.05% FOR A 50% LOAD CHANGE

OUTPUT RIPPLE: 3mV Pk-Pk MAX

TRANSIENT RESPONSE: 30uSECONDS FOR A 50% LOAD CHANGE

OVERLOAD AND SHORT CIRCUIT PROTECTION: AUTOMATIC CURRENT LIMIT/ FOLDBACK

OVER VOLTAGE PROTECTION: SET AT 6.2 ±.4VDC ON +5V ONLY

STABILITY: ±.3% FOR 24HRS AFTER WARM-UP

INPUT FUSING: RECOMMENDED, FUSE AT 4A FOR 115VAC, 2A FOR 230VAC

TEMPERATURE COEFFICIENT: ±.03%/°C MAX

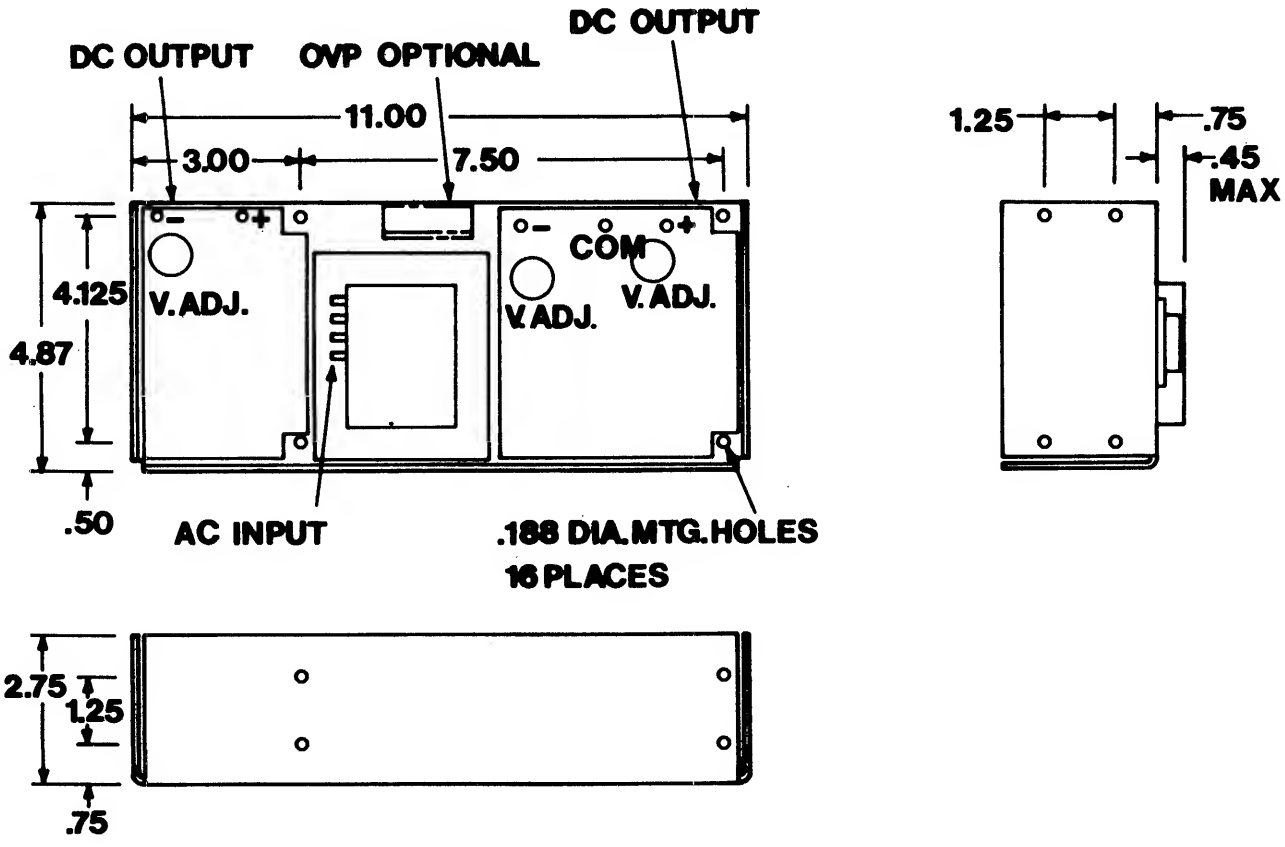
COOLING: UNITS ARE FULL RATED TO 50°C IN FREE AIR, MUST BE FAN COOLED WHEN MOUNTED IN CONFINED AREA

TEMPERATURE RATING:
0-50°C - 100%
60°C - 60%
70°C - 40%

EFFICIENCY: COMBINED EFFICIENCY APPROX. 55% @ 115VAC FULL LOAD ON ALL OUTPUTS

CONSTRUCTION: ALL ALUMINUM CHASSIS

WEIGHT: 8LBS (3.6KG)



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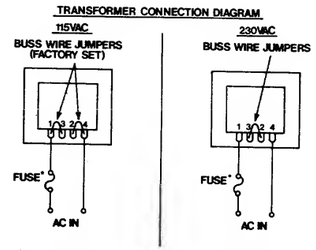
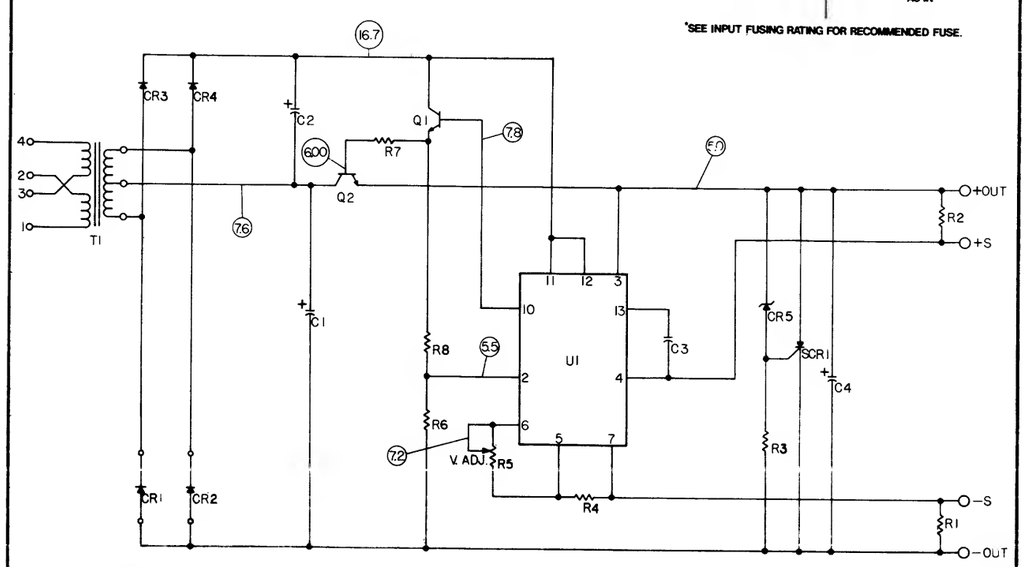
REF. DES.	C5-6/OVP			DESCRIPTION
C1	16000/15V			CAPACITOR, ELECTROLYTIC
C2,4	1000/16V			
C3	.001/100V			CAPACITOR, FILM
CR1,2	MR751			RECTIFIER, 6A 100V
CR3,4	AE1C			RECTIFIER, 1A 200V
CR5	1N752A			ZENER DIODE, 300MW
R1,2	6.8			RESISTOR, 1/2W CF 5%
R3	47			
R4	1.5K			
R6	2.2K			
R7	3.9			
R8	1.1K			
R5	1500			POTENTIOMETER, 2W WW
Q1,2	2N3055			TRANSISTOR, POWER NPN
SCR1	S0308LS3			SCR, 8A 30V
U1	UA723C			I.C. VOLTAGE REGULATOR
T1	10101			TRANSFORMER
P.C.B.	10005			PRINTED CIRCUIT BOARD
CHASSIS	10081			ALUMINUM, ANODIAED

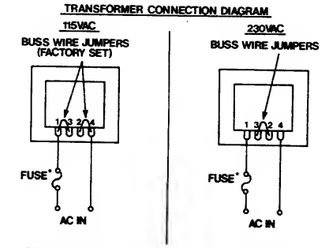


*SEE INPUT FUSING RATING FOR RECOMMENDED FUSE.

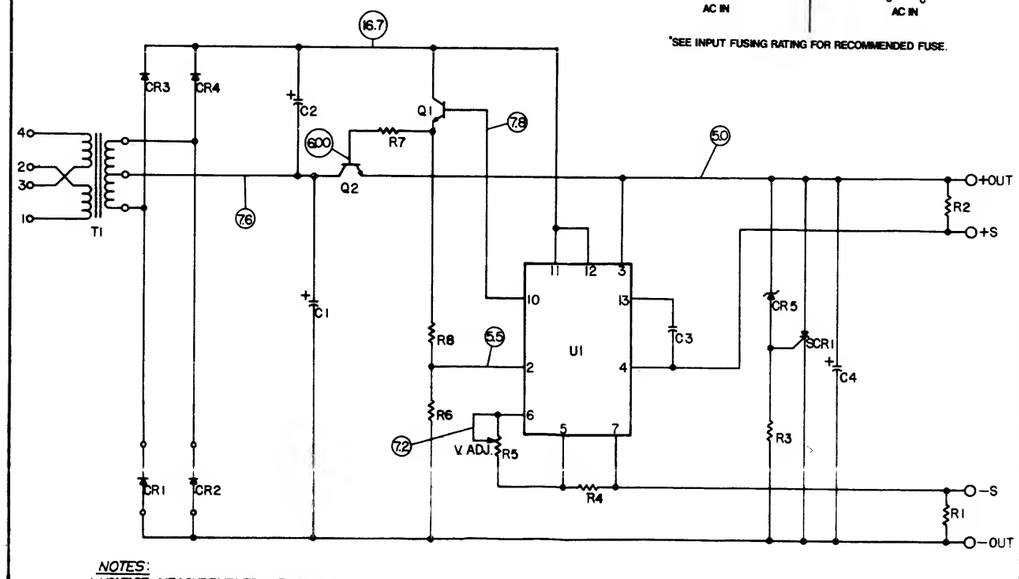


NOTES:
1. VOLTAGE MEASUREMENTS AT 115 VAC INPUT FULL LOAD ON OUTPUT.
2. ALL VOLTAGES REFERENCED TO NEG. OUTPUT.
3. (5.0) DENOTES 5V UNIT.

REF. DES.	C5-6/OVP			DESCRIPTION
C1	16000/15V			CAPACITOR, ELECTROLYTIC
C2,4	1000/16V			
C3	.001/100V			CAPACITOR, FILM
CR1,2	MR751			RECTIFIER, 6A 100V
CR3,4	AE1C			RECTIFIER, 1A 200V
CR5	1N752A			ZENER DIODE, 300MW
R1,2	6.8			RESISTOR, 1/2W CF 5%
R3	47			
R4	1.5K			
R6	2.2K			
R7	3.9			
R8	1.1K			
R5	1500			POTENTIOMETER, 2W WW
Q1,2	2N3055			TRANSISTOR, POWER NPN
SCR1	S0308LS3			SCR, 8A 30V
U1	UA723C			I.C. VOLTAGE REGULATOR
T1	10101			TRANSFORMER
P.C.B.	10005			PRINTED CIRCUIT BOARD
CHASSIS	10081			ALUMINUM, ANODIAED



*SEE INPUT FUSING RATING FOR RECOMMENDED FUSE.



NOTES:
1. VOLTAGE MEASUREMENTS AT 115 VAC INPUT FULL LOAD ON OUTPUT.
2. ALL VOLTAGES REFERENCED TO NEG. OUTPUT.
3. (5.0) DENOTES 5V UNIT.

Microcomputer Power, Inc.
2272 Calle de Luna, Santa Clara, CA 95050
(408) 988-0265 TWX 910 338-7694

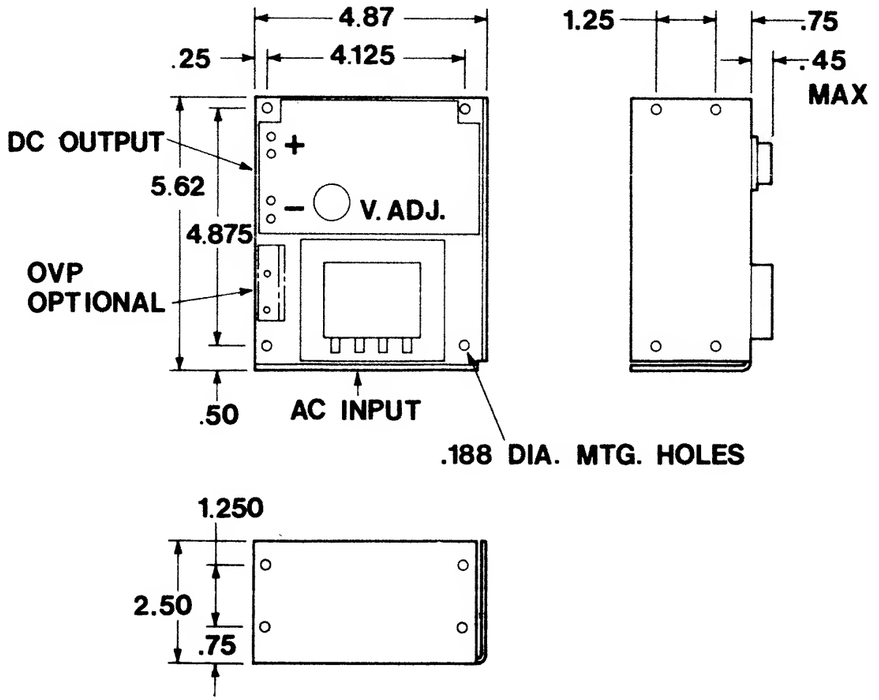
APPLICATION DATA INCLUDING:
1. SCHEMATIC
2. PARTS LIST
3. SPECIFICATION
4. OUTLINE & MOUNTING DRAWING

MODEL
C5-6/OVP

SPECIFICATIONS:

AC INPUT: 115/230VAC ±10%
47-63Hz
DC OUTPUT: 5VDC AT 6.0AMPS
LINE REGULATION: ±.05% FOR A 10% LINE CHANGE
LOAD REGULATION: ±.05% FOR A 50% LOAD CHANGE
OUTPUT RIPPLE: 3mV Pk-Pk MAX
TRANSIENT RESPONSE: 30uSECONDS FOR A 50% LOAD CHANGE
OVERLOAD AND SHORT CIRCUIT PROTECTION: AUTOMATIC CURRENT LIMIT/ FOLDBACK
OVER VOLTAGE PROTECTION: SET AT 6.2 ±.4VDC
STABILITY: ±.3% FOR 24HRS AFTER WARM -UP

INPUT FUSING: RECOMMENDED, FUSE AT 2A FOR 115VAC, 1A FOR 230VAC
TEMPERATURE COEFFICIENT: ±.03%/°C MAX
COOLING: UNITS ARE FULL RATED TO 50°C IN FREE AIR, MUST BE FAN COOLED WHEN MOUNTED IN CONFINED AREA
TEMPERATURE RATING:
0-50°C - 100%
60°C - 60%
70°C - 40%
EFFICIENCY: AT 115VAC, FULL LOAD ON OUTPUT - 45%
CONSTRUCTION: ALL ALUMINUM CHASSIS
WEIGHT: 4LBS (1.8KG)



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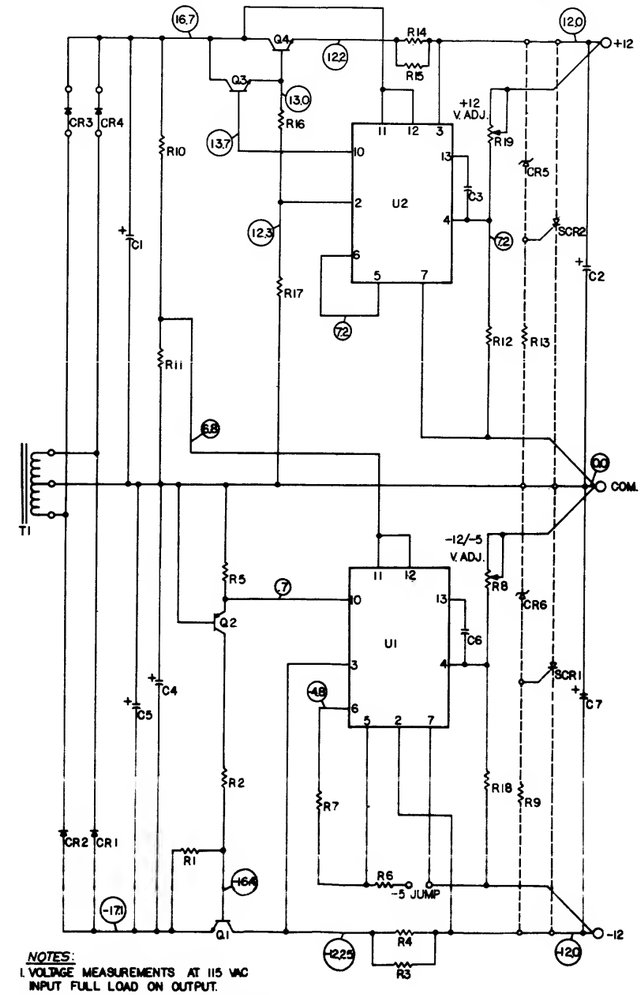
REF. DES.	CP134	CP135	CP136	DESCRIPTION
C1	7300/35V	7300/35V	7300/35V	CAPACITOR, ELECTROLYTIC
C4,5	470/35V	470/35V	470/35V	
C7	100/35V	100/35V	100/35V	
C3,6	.001/100V	.001/100V	.001/100V	CAPACITOR, FILM
CR1,2	AE1C	AE1C	AE1C	RECTIFIER, 1A 200V
CR3,4	MR751	MR751	MR751	RECTIFIER, 6A 100V
CR5,5	-	-	-	ZENER DIODE, 300MW
R1,2,5	330	330	330	RESISTOR, 1/2W CF 5%
R10,11,16	330	330	330	
R3,4	1	1	1	
R6,7	2.2K	2.2K	2.2K	
R9,13	-	-	-	
R12,18	1.1K	1.1K	1.1K	
R17	4.7K	4.7K	4.7K	
R14,15	.12	.12	.12	RESISTOR, 2W WW
R8,19	1500	1500	1500	POTENTIOMETER, 2W WW
Q1,4	2N3055	2N3055	2N3055	TRANSISTOR, POWER NPN
Q2	2N2905A	2N2905A	2N2905A	TRANSISTOR, SIGNAL PNP
Q3	TIP31A	TIP31A	TIP31A	TRANSISTOR, POWER NPN
SCR1,2	-	-	-	SCR, 3A 30V
U1,2	UA723C	UA723C	UA723C	I.C. VOLTAGE REGULATOR
T1	10333	10334	10335	TRANSFORMER
P.C.B.	10324	10324	10324	PRINTED CIRCUIT BOARD
CHASSIS	10088	10091	10089	ALUMINUM, ANODIZED



NOTES:
1. VOLTAGE MEASUREMENTS AT 115 VAC INPUT FULL LOAD ON OUTPUT.
2. ALL VOLTAGES REFERENCED TO COM. OUTPUT.

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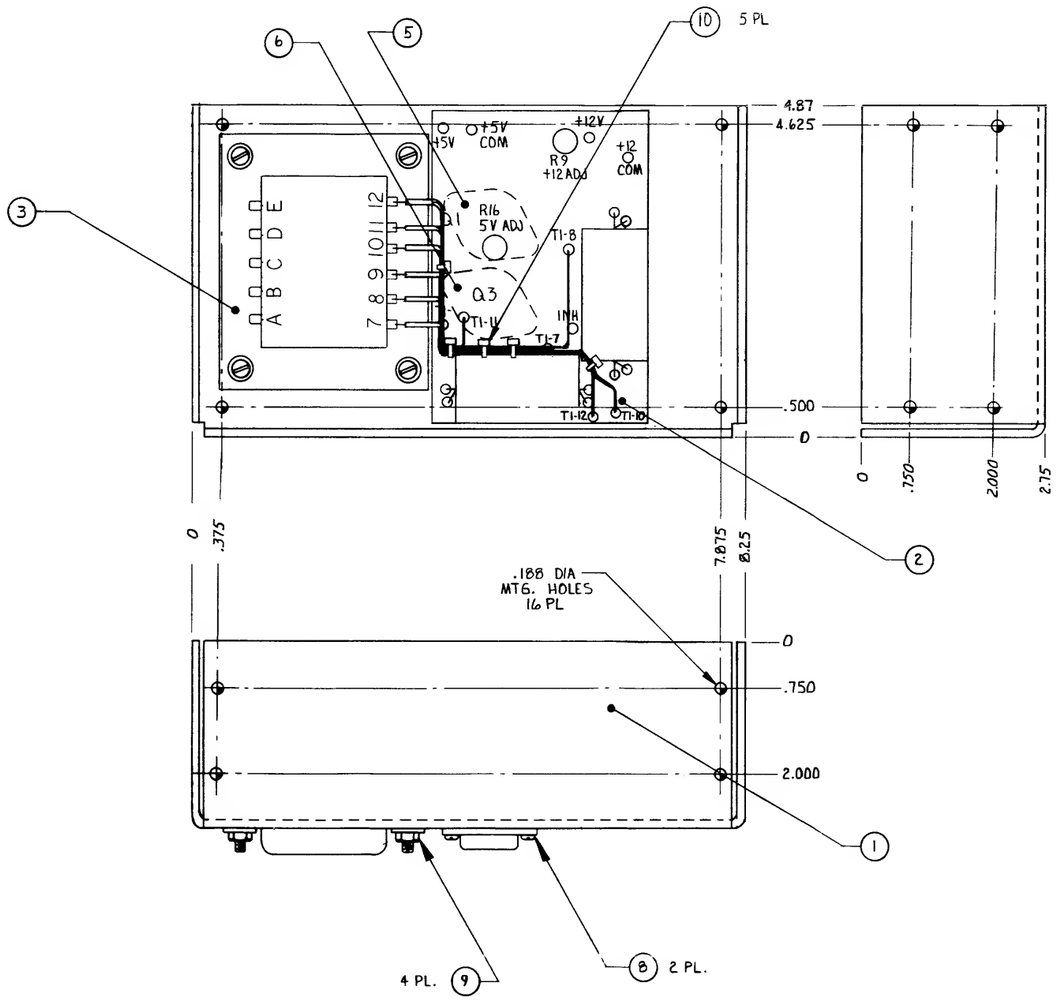
REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED
	A	PROD RELEASE	3-9-81	K.C.
5208	B	INC ECO	7-1-81	



QTY REQD	ITEM	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	POWER-ONE STD. P/N
5	10		TY WRAP	316-10440
4	9	6-32	NUT, KEP	340-10602
2	8		MTG KIT, TO-3	086-20130
	7			
1	6	2N6055	TRANSISTOR TO-3	171-10263
1	5	2N3771	TRANSISTOR TO-3	171-10245
	4			
1	3		TRANSFORMER	082-19259
1	2		PRINTED CIRCUIT BOARD	081-19267
1	1		CHASSIS	412-19464

PARTS LIST

NOTES: UNLESS OTHERWISE SPECIFIED

TOLERANCE .XX = .030 .XXX = .010

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	1-20-81
CHECKED	3-9-81
ENG. APP.	3-9-81
APPROVED	

POWER-ONE INC. CAMARILLO, CALIF. 93010 (805) 484-2806

TITLE: ASSEMBLY

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	54407	19263	B

SCALE 1/1 | SHEET 1 OF 1

NEXT ASSY	USED ON
	CP417

APPLICATION

BISHOP GRAPHICS/ACCUPRESS REORDER NO. A-6484

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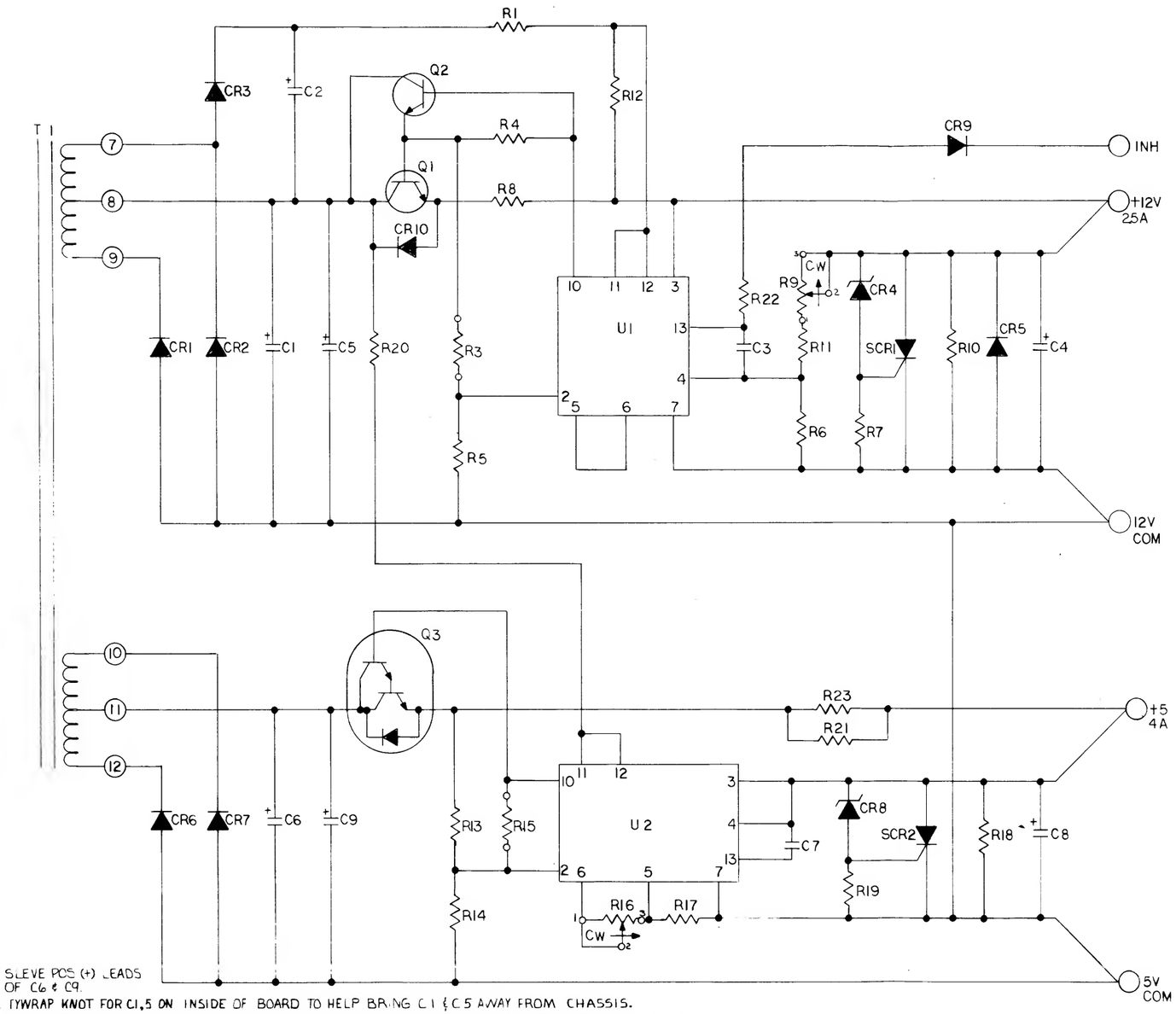
REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED
	A	PROD RELEASE	3-9-81	K L
6330	B	ADDED & MOVED PRODUCTION NOTES	2-22-82	
7016	C	CHANGED PART NUMBER & VALUE ON R20	6-22-82	



REF DES	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	POWER-ONE STD P/N
C4,2	100/35 V	CAPACITOR ELECT	101-10110
C8	220/16 V		101-10107
C1,5	3300/35 V		102-10099
C6,9	9000/15 V	ELECT	102-10097
C3	.001/100 V	MYLAR	104-10093
C7	.01/100 V	CAPACITOR MYLAR	104-10095
CR1,2,6,7	MR 750	DIODE 50 V	111-10256
CR3,5,9,10	IN4003	200 V	111-10251
CR4	——	ZENER	——
CR8	IN752A	DIODE ZENER 5.6V	112-10006
SCR1	——	SCR	——
SCR2	S0303L53	SCR 3A 30V	160-10258
Q1	2N3771	TRANSISTOR, POWER NPN	171-10245
Q2	2N6551	TRANSISTOR, POWER NPN	172-10249
Q3	2N6055	TRANSISTOR, POWER NPN	171-10263
U1,2	μA723	I.C. VOLTAGE REGULATOR	130-10287
R7	——	—— ——	——
R1,12	1.6K	RESISTOR ½W 5% C.F.	151-10370
R3	270Ω		10351
R4,17,22	2.2K		10373
R5	2.7K		10375
R15	300Ω		10352
R10,14	1K		10365
R11	1.2K		10367
R13,	330Ω		10353
R18,19	82Ω		10339
R20	300Ω		10352
R6	2.4K	RESISTOR ½W 5% C.F.	151-10374
R8	.12Ω	RESISTOR BWH 2W WW	158-10077
R21,23	.22Ω	RESISTOR BWH 2W WW	158-10079
R9,16	2K	POTENTIOMETER ±10% .2W	154-20020
T1		TRANSFORMER	082-19259
P.C.B.		PRINTED CIRCUIT BOARD	505-19267

PARTS LIST

6. SLEVE POS (+) LEADS OF C6 & C9.
5. TYWRAP KNOT FOR C1,5 ON INSIDE OF BOARD TO HELP BRING C1 & C5 AWAY FROM CHASSIS.
4. FACE BOTTOM PART OF CAP CRADLE TOWARD THE CENTER OF P.C.B. AND RTV CRADLE & CAP. ON C1,5,6,9.
3. THIS BOARD IS TESTED ON FAULTFINDER DO NOT CHANGE P.C.B. WITH CONSULTING TEST ENGINEERING.
2. R4 TO BE INSTALLED BEFORE Q2.
[1] FACE FLAT SIDE OF HEATSINK TOWARD C5.

NOTES: UNLESS OTHERWISE SPECIFIED

QTY	STD. P/N	DESCRIPTION	USED ON
2	321-10679	I.C. SOCKET	U1,2
1	332-19703	HEATSINK	Q2
4	336-10678	TY-WRAP 11½"	C1,5,6,9
2	340-10673	HEATSINK WHT	C6,C9
4	344-19510	CAP CRADDLE DUAL	C1,C5,C6,C9

HARDWARE LIST

LAST REFERENCE DESIGNATION USED			
C 9	CR 10	Q 3	R 23
SCR 2	T 1	U 2	E ——
NOT USED			
R 2			

NEXT ASSY	USED ON
CP417	

APPLICATION

TOLERANCE .XX = 030 .XXX = 010

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	1-7-82
CHECKED	1-18-82
ENG. APP.	2-9-82
APPROVED	

POWER-ONE INC. CAMARILLO, CALIF. 93010 (805)484-2806

TITLE: SCHEMATIC

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	54407	19269	C

SCALE 3/1 SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO A-4994

THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPRIETARY [redacted] AND ARE TO BE USED ONLY FOR [redacted] OF MANUFACTURING PARTS FOR [redacted]

REV	DATE	EC NO.	REV	DATE	EC NO.	263-00053-00	
AA		302				NEXT ASSEMBLY	USED ON
BB		338					
CC		369					

+11.5V
+5V
+12V
R40 2.7K
R41 2.7K
C15 .001
C16 .001
R45 750
C20 .1
R46 510
R47 510
R50 6.2K
R51 6.2K
C28 .01
C29 .01
L1 22μH
L2 22μH
C21 22pF
R95 1.2K
C30 22μF
U28 1350
.1 VPP
R42 51
C18 .1
C23 10μF
READ MON. (3 VPP)
TP3
R49 220
C31 .001
R63 820
U29 592
C33 220PF
C32 220PF
Q9 2N2369
Q10 2N2369
R59 10K
R61 5.1K
R62 5.1K
R64 2.7K
TP9
R80 5.1K
C27 150PF
C40 .01
R81 51
R74 2.7K
C36 220 PF
C38 150PF
R73 100
R76 220
R77 220
R78 100
C39 150PF
R75 2.7K
C37 220 PF
U27 116
R89 510
R88 510
R85 510
R84 510
R97 330
R96 330
R58 820
R57 820
C26 150PF
Q8 2N5771
Q7 2N5771
R55 270
R56 270
U24 300
U26 S04
READ DATA
SH 2 / 3
SH 3
R5, 510
U25
CR8 IN4148
CR7 IN4148
CR17 IN4148
CR16 IN4148
CR13 IN4148
CR12 IN4148
CR18 IN4148
CR19 IN4148
CR14 IN4148
CR15 IN4148
H2A → J31-8
H2B → J31-10
H0A → J31-14
H0B → J31-16
H3B → J31-7
H3A → J31-5
H1B → J31-13
H1A → J31-11
SPARE → J31-17
HEAD GND → J31-18
R33 75Ω
C14 .01
R34 510Ω
R39 270Ω
R35 510Ω
Q5 2N2907
Q6 2N2907
R36 51
R37 51
R94, 100Ω
R91, 100Ω
Q5 2N2369
Q4 2N2369
C11 .1
SH 2 PS FAULT
TP1 ENCODED DATA
R24 510
R25 510
SH 3 ENCODED DATA
U16 S74
RP1
J34-14 -WRITE GATE
J36-14
J34-10 +HAR1
J36-10
J34-11 +HAR0
J36-11
J34-6
J36-6 WRITE DISABLE
U8 LS14
R23 1.2K
U2 3487
CR11
R18 1.2K
C49 .001
C50 .001
U3 LS14
U9 7445
R28 24K
R27 24K
R29 24K
R26 24K
+WRITE SH 3
HEAD SEL 2 → J31-15
HEAD SEL 1 → J31-12
HEAD SEL 0 → J31-9
HEAD SEL 3 → J31-6

NOTES: UNLESS OTHERWISE SPECIFIED,

+5V
1K
PIN NO.
1. [redacted] IS EQUIV TO (A RESISTOR PACK)

2.

3. LAST REFERENCE DESIGNATORS USED R94 TP12, U29, Q10, CR20 C52, L2.

4. REFERENCE DESIGNATORS NOT USED, R43, R7, R71 R44, R85, U10, U11, U17, C41, C48, C17, C19, CR5, CR6, R50, R91

5

TABULATION	
-101	USE CONNECTOR J34
-102	USE CONNECTOR J36

- MASTER -

ENG'R. NO. 400043

MATERIAL	SCALE N/A	IMI INTERNATIONAL MEMORIES, INCORPORATED
FINISH	DRAWN PENTECH 4/80	PHASE 3 READ/WRITE, 2V
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN TOLERANCES	CHECKED JKS 29 JAN 81	D 263-00053-100 CC
DECIMAL .XX ± .XXX ±	FRACTIONAL ± ANGULAR ±	APPROVED [redacted] SHEET 1 OF 4 REV.

THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF IMI AND ARE TO BE USED ONLY FOR THE PURPOSE OF MANUFACTURING PARTS FOR IMI.

REV	DATE	EC NO.
AA		302
BB		338
CC		369

REV	DATE	EC NO.

263-00053-100

NEXT ASSEMBLY	USED ON

P.S. VOLTAGE FAULT

+12V
R14 510Ω
CR4 1N5234 6.2V 2%
R10 22K
+6.7V
U12 339
R12 4.3K
R11 4.3K
+5V
PS FAULT → SH-1
R15 10K
+4.4V
+5V
-PWR LOSS → J34-12 [5]
J36-12
R16 24K
READ → SH 3
+3.7V
R13 24K

ERROR AMP.
+12V
R53 4.3K
R54 4.3K
R68 2.7K
U25 CA3046
TP11 ERROR VOLTAGE +6V ± 1V
C35 .01
R46 510
R67 510
C24 .01
R65 51
C34 470pF
R70 2.7K
R69 2.7K
R52 1.2K
R73 2.7K
R72 2.7K
VCO (31ME)
R32 4.7
C25 47pF

+5V
R90 1.2K
H1
U21 S74
U18 S04
U18, S04 READ
U19 LS74
-DATA SYNC
TP-10
SH 1 READ DATA
U20 S00
TP-5 REF.
VCO
TP-6
U22 IK44
U23 S158
U24 S00
U26 S03
VCO CLK → SH 3
VCO CLK → SH 3
VCO ENABLE → SH 3

[5] J34-13 -READ GATE
J36-13
RP1
U18 LS14
[5] J34-26
J36-26
J39-25
J36-25
7.6MHZ
R3 22Ω
TP1-5
U1 MC3486
U9 LS14
CR10 READ GATE
U16 S74
CLK GENERATOR

-MASTER- ENG'R. NO. 400043

MATERIAL	SCALE N/A	IMI INTERNATIONAL MEMORIES INCORPORATED
FINISH	DESIGN PENTECH '11	PHASE 3, READ/WRITE, 2V
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES:	CHECKED OKS 2-7-81	D 263-00053-100 CC
DECIMAL .XX ± .XXX ±	FRACTIONAL ± ANGULAR ±	SHEET 2 OF 4 REV.

THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF IMI AND ARE TO BE USED ONLY FOR THE PURPOSE OF MANUFACTURING PARTS FOR IMI.

REV	DATE	EC NO.
AA		302
BB		338
CC		369

263-00053-100

SEE SHT 1 FOR REV

ENCODER

J36-23 WR DATA
J34-23
R2 220Ω
J34-22
WR DATA
J36-22
RP1
U1 MC3486
H2
U5 LS74
U6 LS00
LS14
@ ENCODE
+5V
R22 1.2K
U13 S74
ENCODED DATA — SH 1
SH 1 +WRITE
1 U6 LS00 3 !ENCODE

SPARE → J36-21
SPARE → J36-1
SPARE → J36-2
SPARE → J36-3
SPARE → J34-21
→ J34-15,18,24

DECODER

H1
DECODE CLK TP-4
DECODE DATA TP-8
U15 S74
U14 S74
U13 S74
SH 2 VCO CLK
SH 2 VCO ENABLE
SH 2 $\overline{\text{VCO CLK}}$
SH 1 READ DATA
SH 2 READ

7.6 MΣ
RP1
+5V
U2 MC3487
+R/W CLOCK → J34-17, J36-17
-R/W CLOCK → J34-16, J36-16
+RD DATA → J34-20, J36-20
-RD DATA → J34-19, J36-19
J36-18,15,24

- MASTER -
ENG'R. NO. 400043
N/A
PENTECH 7/84
IMI
PHASE 3, IMI READ/WRITE, 2V
D 263-00053-100 CC
SHEET 5 OF 4

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REV	DATE	EC NO.
AA		302
BB		338
CC		369

263-00053-100

NEXT ASSEMBLY | USED ON

+12V

J36-5 / J34-5 — Z/12 V — RP1 3 — U3 LS14 — U7 06 — R19 680 — R20 510 — R21 1.2K — 2N4032 Q2 — R8 2.7K — C7 1.0 — C42 .001 — R6 220 — 2N2222A Q1 — +5V — C8 10

J36-8 — STEP — J34-8

J34-7 — DIRECTION IN — J36-7

U3 LS14 — U4 SAA1042 — R9 47K — FULL

COIL 1A — J31-1
COIL 1B — J31-2
COIL 2A — J31-3
COIL 2B — J31-4

J39-4 / J36-4 — STEPPER DISABLE — U6 LS14 — U7 06 — +5V

J37-1 — +5V

J37-4 — GND

TP7 — C51 .001 — CR20 — R92 4.3K — C45 .1 — C52 .1 — U12 339 — R1 1.2K — +5V

J37-2 — PHOTO OUTPUT — R4 2.7K

B PHOTO — J34-9 / J36-9

J37-3 — DIODE I — RB2 75 — +5V

R48 4.7 — +11.5 V — C22 10 µF 20V

J35-1 — +12 V — +12V — C44 .1

CR1 IN4001

J34-1,3

J35-6 — +5V — +5V

C2 10 — CR3 IN4001 — C1 .1 — C4 10 — C5,6,9,10,12,13,43,46,47,41 .1

J35-2 — GND — GND — TP2 — TP12

C3 .1 — CR2 IN4001

J34-2

J35-5 — -5V

BREAK — J38-1 / J38-4

M+12V — J35-3 — M+12V — J38-3

M COM — J35-4 — M COM — J38-2 / J38-5

— MASTER —

ENG'R. NO. 400043

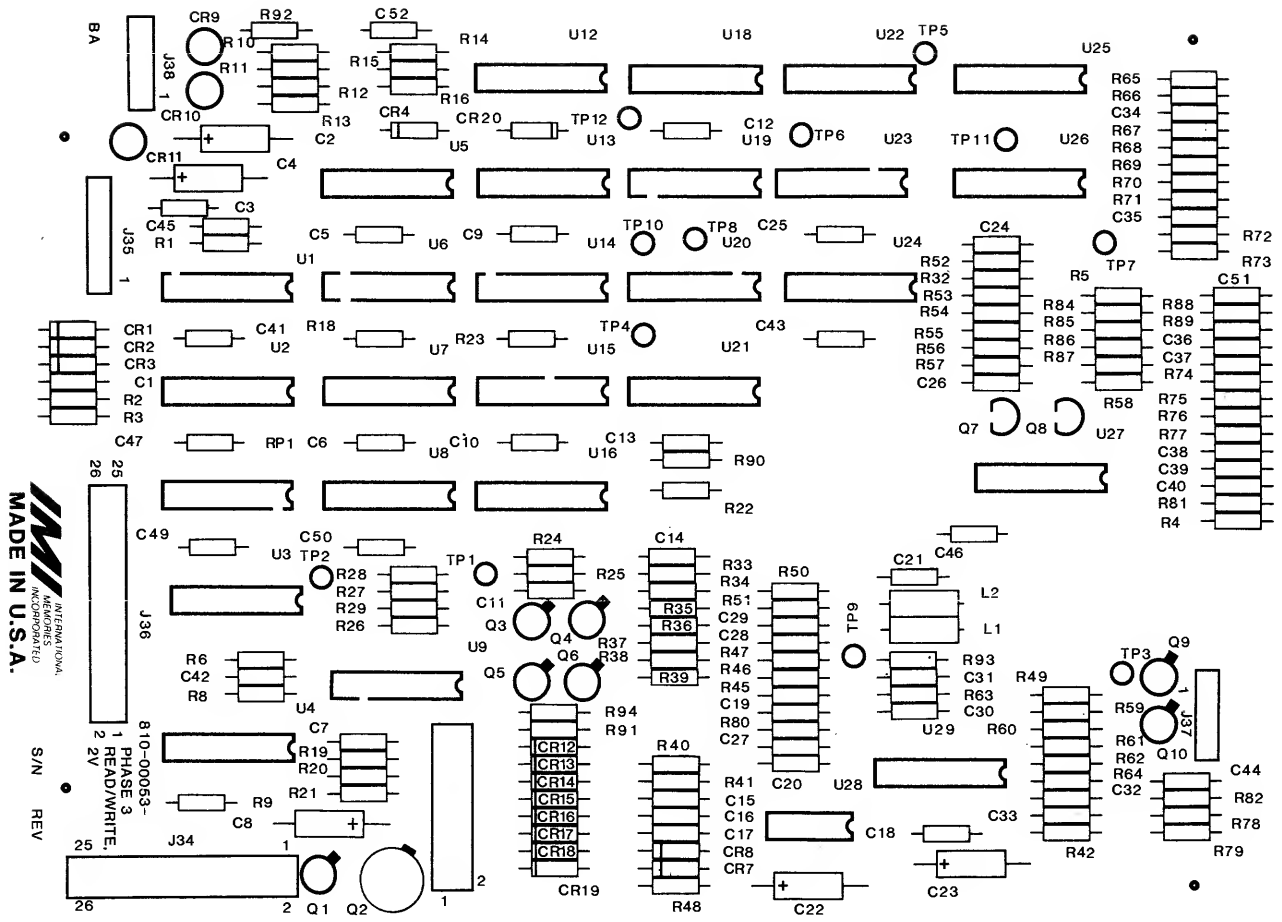
NONE

IMI INTERNATIONAL MEMORIES INCORPORATED

PHASE 3, 2V, READ/WRITE

D | 263-00053-100 | CC

SHEET 4 OF 4 | REV.


MADE IN U.S.A.
INTERNATIONAL MEMORIES INCORPORATED
810-00053-
PHASE 3
READ/WRITE
S/N
REV
J38
J35
J36
J34
J37
U1
U2
U3
U4
U5
U6
U7
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TP9
TP10
TP11
TP12
Q1
Q2
Q3
Q4
Q5
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Q7
Q8
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Q10
CR1
CR2
CR3
CR4
CR5
CR6
CR7
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R78
R79
R80
R82
R84
R85
R86
R87
R88
R89
R90
R91
R92
R93
R94
RP1
L1
L2

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REV	DATE	ECO NO.
AA	9-15-81	301
BB	10-16-81	344

263-00055-200

NEXT ASSEMBLY | USED ON

NOTES UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS (Ω), ¼W, 5%
2. ALL CAPACITORS ARE MICRO FARADS (mf)
3. ALL SN74XX SERIES I.C.'S:
   - A. 14 PIN - PIN 14 = +5V, PIN 7 = GND
   - B. 16 PIN - PIN 16 = +5V, PIN 8 = GND
   - C. 20 PIN - PIN 20 = +5V, PIN 10 = GND

4 MK4118 (1K×8 RAM) IS CUSTOMER INSTALLED OPTION ONLY.

5

-201	C66 IS: 47PF
-202	C66 IS: 120PF

RP5 4.7K

RP3 4.7K

RP5 4.7K

U24 LS08

U67 LS245 DIR

U47 Z80A-CPU

U48 LS138

U62 LS08

U25 LS11

U55 2114 L RAM (1K×4)

U56 2114 L RAM (1K×4)

U57 2114 L RAM (1K×4)

U58 2114 L RAM (1K×4)

U59 2114 L RAM (1K×4)

U60 2114 L RAM (1K×4)

U31 2716 (2K×8)

U32 2716 (2K×8)

U33 2716 (2K×8) OR 4

RAM JUMPER

ROM JUMPER

+5V

RAM JUMPER

ROM JUMPER

SYSTEM CONTROL BUS SH4

U34 LS74

U35 LS54

U36 9401

U39 LS166

U40 LS374

U41 LS164

U42 74

U50 LS00

U26 LS04

R17 4700

+5V

MREQ SH4

QA (SH3)

CRC ERROR SH2

WRITE DATA SH6 - ORIGINAL

C64 .1

C63 10

C2-C13 .1

C15, C18 .1

C20-C22 .1

C1, C14, C16, C17, C19, C23-C57, C61, C64 .1

C67 10μf

C68 .1

-5V

+5V

+12V

RAM BUS SH4

DATA BUS SH2,3

ADDRESS BUS SH2,3,4

Y4 SH4

Y3/5 SH4

INTERRUPT SH2

DSK WAIT SH3

EXT WAIT SH4

NMI SH2

SH3

RESET SH4

RAM BUS ENABLE SH4

WR DSK/MEM SH3

WR EXT/MEM SH4

MEMORY ENABLE SH2

DISK ↔ MEM SH4

-WRITE GATE SH3

EOB SH3

-RD GATE SH3

HEADER/DATA SH3

RDAT SH6

CLOCK SH3

CLKEN SH3

PST SH3

-CLOCK SH3

EOB SH3

ORIGINAL ENG'R. NO. 400037

IMI INTERNATIONAL MEMORIES, INCORPORATED

5000 PHASE III CONTROLLER

D 263-00055-200 BB

THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF IMI AND ARE TO BE USED ONLY FOR THE PURPOSE OF MANUFACTURING PARTS FOR IMI.

REV	DATE	EC NO
AA	9-15-81	301
BB	10-16-81	344

REV	DATE	EC NO

263-00055-200

NEXT ASSEMBLY	USED ON

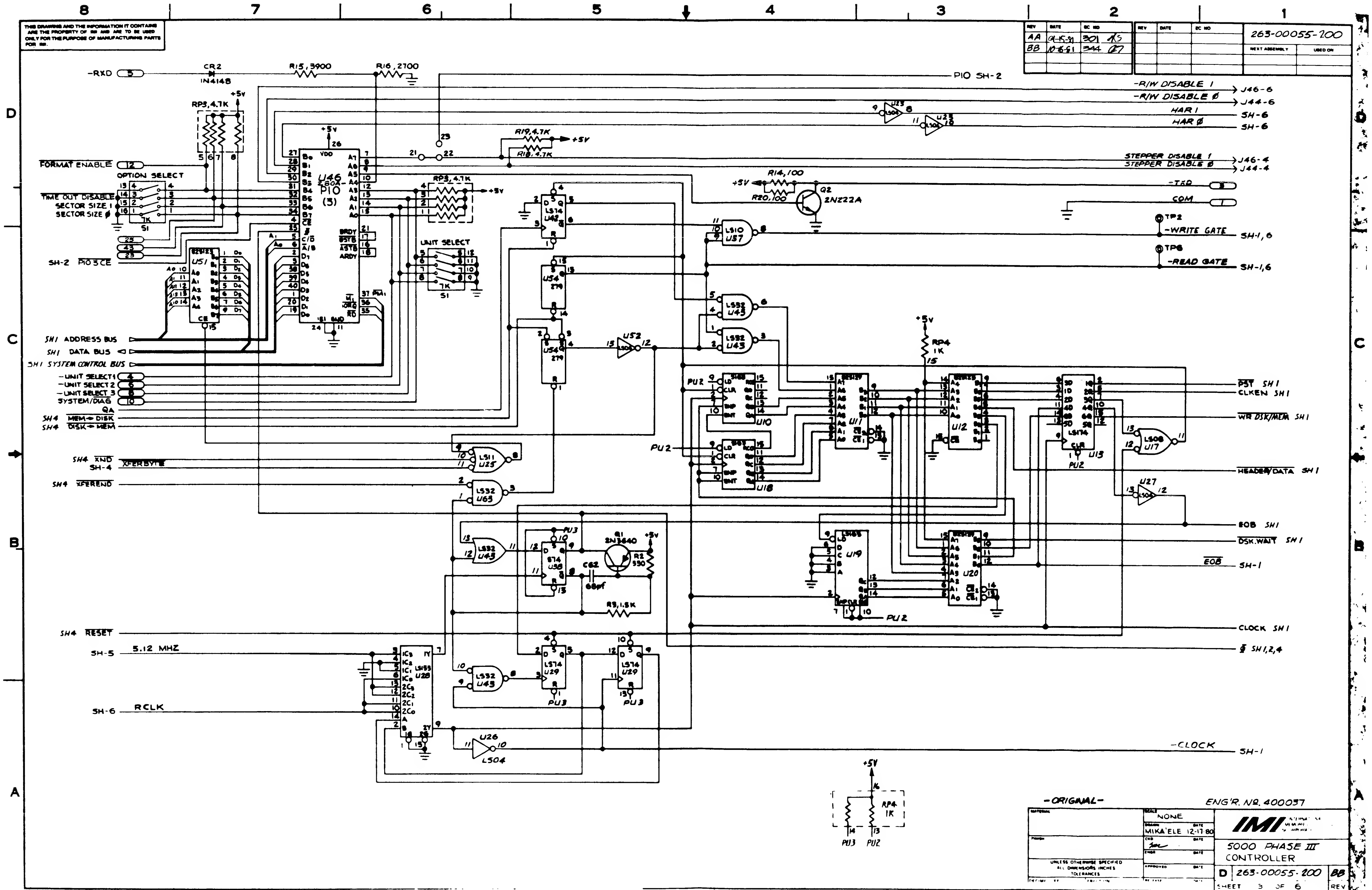
+5V
U23 LS04
U53 279
U16 LS32
U30 Z80A-CTC
U22 LS138
U45 Z80A PIO (0)
U44 Z80A PIO (2)
U64 07
U16 LS32
SH5 INDEX
SH5 SECTOR
SH4 RESET
ZC/TO2
MEMORY ENABLE SH1
NMI SH1
PIO3CE SH3
BEGRDY SH4
H3XCLR SH4
XFER3TB SH4
SH1 DATA BUS
SH1 ADDRESS BUS
SH1 SYSTEM CONTROL BUS
SH3 Ø
INTERRUPT SH1,4
SH1 CRC ERROR
19 -WR PROTECT 1
18 -WR PROTECT Ø
RP5 4.7K
R12,120
R13 120
CR4
R4 4.7K
R21 4.7K
R5 1.2K
R6 1.2K
R7 4.7K
R8 4.7K
RP3,4.7K
RP5 4.7K
106 -COMPL
104 -ALT SEL
110 -DRV ACK
111 BUS DIR
105 -SYNC
H5XFER SH14
PIO RDY SH4
STROBE SH4
91 -STROBE
95 DATA BIT Ø
96 DATA BIT 1
97 DATA BIT 2
98 DATA BIT 3
99 DATA BIT 4
100 DATA BIT 5
101 DATA BIT 6
102 DATA BIT 7
COMMAND BUS SH4
SH·6 -SELECTED PWR LOSS
SH·6 +ANY PWR LOSS
SH·4 H5XSTB
SH·3 PIO
D/T SELECT SH·6
+12 VOLTS SH·6
M-TEB SH·6
DIRECTION IN SH·6
7 ACTIVITY LED

-ORIGINAL-

ENG'R NO. 400037

MATERIAL	SCALE NONE	IMI
Finish	DRAWN MIKE 4-21-81 DATE	5000 PHASE III CONTROLLER
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES DECIMAL XX ± XXX ± FRACTIONAL ± ANGULAR ±	CHD DATE / ENGR DATE / APPROVED DATE / RELEASED DATE	D 263-00055 200 BB SHEET 2 OF 6 REV

77


THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF IMI AND ARE TO BE USED ONLY FOR THE PURPOSE OF MANUFACTURING PARTS FOR IMI.
263-00055-200
-RXD
CR2
IN4148
R15, 3900
R16, 2700
PIO SH-2
-R/W DISABLE 1
-R/W DISABLE Ø
HAR 1
HAR Ø
J46-6
J44-6
SH-6
RP3, 4.7K
+5V
R19, 4.7K
R18, 4.7K
FORMAT ENABLE
OPTION SELECT
STEPPER DISABLE 1
STEPPER DISABLE Ø
J46-4
J44-4
U46
Z80A-PIO
TIME OUT DISABLE
SECTOR SIZE 1
SECTOR SIZE Ø
R14, 100
R20, 100
Q2
2N2222A
-TSO
COM
TP2
-WRITE GATE
SH-1,6
TP6
-READ GATE
SH-2 PIO3CE
UNIT SELECT
U51
S1
SH1 ADDRESS BUS
SH1 DATA BUS
SH1 SYSTEM CONTROL BUS
-UNIT SELECT 1
-UNIT SELECT 2
-UNIT SELECT 3
SYSTEM/DIAG
QA
SH4 MEM→DISK
SH4 DISK→MEM
RP4 1K
PST SH1
CLKEN SH1
WR DISK/MEM SH1
SH4 XND
SH-4 XFERBYTE
SH4 XFEREND
HEADER/DATA SH1
EOB SH1
DSK.WAIT SH1
EOB SH-1
Q1
2N3640
R2 330
C62
68pf
R3, 1.5K
SH4 RESET
CLOCK SH1
SH-5 5.12 MHZ
SH1,2,4
SH-6 RCLK
U28
U29
U26
LS04
-CLOCK SH-1
PU3
PU2
-ORIGINAL-
ENG'R. NO. 400057
NONE
MIKA'ELE 12-17-80
IMI
5000 PHASE III
CONTROLLER
D 263-00055-200 BB
SHEET 3 OF 6

THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF IMI AND ARE TO BE USED ONLY FOR THE PURPOSE OF MANUFACTURING PARTS FOR IMI.

REV	DATE	EC NO
AA	1-15-81	301 KS
BB	10-16-81	324 KS

REV	DATE	EC NO

263-00055-200

NEXT ASSEMBLY	USED ON

SH2 PIO RDY
SH2 HSXFER
SH2 XFERSTB
SH2 STROBE
SH3 Φ
SH2 HSXCLR
SH2 INTERRUPT
SH2 BEGRDY
COMMAND BUS SH2
SH1 V4 AREQ
SH1 Y5/5
SH1 ADDRESS BUS
SYSTEM CONTROL BUS SH1

U48 LS132 · R11, 620 · U68 LS132 · C61, 5
U70 LS74 · U116 LS32 · U50 LS00 · U25 LS11 · U24 LS08 · U64 07 · RP4 1K +5V
93 RDY
HSXSTB SH-2
XFERBYTE SH-3
EXT WAIT SH1
WR EXT/MEM SH1
XFEREND SH3
RAM BUS SH1
U61 LS74 · U63 LS32
U62 LS08 · CR1 HPS082-2835
U138 LS74
U139 LS156
RP1, 1K +5V
U69 LS164
U52 LS04
U70 LS74
R10 10K · CR5 IN4148 · C59 2.2μf · R8 1KΩ · C65 .01
RP5 4.7K · R9, 100 · -SYS. RST.
DISK=MEM SH1,3
XMD SH3
MEM=DISK SH3
RAM BUS ENABLE SH1
RESET SH1,3
SYSTEM CONTROL BUS SH2,3
M1 PMI MREQ WR RD

-ORIGINAL-
ENG'R. NO. 400037

SCALE	NONE
DRAWN	MIKE 1-27-81
CHD	
ENGR	
APPROVED	
RELEASED	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES
DECIMAL XX ± XXX ± · FRACTIONAL ANGULAR ±

IMI
5000 (PHASE III) CONTROLLER
D 263-00055-200 BB
SHEET 4 OF 6 REV

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REV	DATE	EC NO
AA	9-15-81	301
BB	10-16-81	344

REV	DATE	EC NO

263-00055-200

NEXT ASSEMBLY	USED ON

7.5 MHZ — SH-6

+5V

U5 15.36 MHZ

U6 LS393 — U6 LS393 — U7 LS393 — U7 LS393

U23 LS04

U14 LS74

U15 LS02 — U27 LS04

$\overline{SECTOR}$ — TP4 — SH-2

$\overline{INDEX}$ — TP3 — SH-2

U21 LS92

195 μSEC

5.12 MHZ — SH-3

SH-4 $\overline{RESET}$

U11 LS74 — U12 LS74 — U14 LS74

PU1

TP8

TP9

TP10

TP1

SH-6 M PHOTO

U9 LS04

80

-ORIGINAL- ENG'R. NO. 400037

MATERIAL	SCALE NONE	IMI INTERNATIONAL MEASURES INCORPORATED
FINISH	DRAWN MIKE 4.20.81	5000 PHASE III CONTROLLER
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES	CHK / ENGR / APPROVED / RELEASED	D 263-00055-200 BB
DECIMAL .XX ± .XXX ± FRACTIONAL ± ANGULAR ±		SHEET 5 OF 6 REV

THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF IMI AND ARE TO BE USED ONLY FOR THE PURPOSE OF MANUFACTURING PARTS FOR IMI.

REV	DATE	EC NO
AA	9-15-81	301
BB	11-16-81	344

263-00055-200

NEXT ASSEMBLY | USED ON

+5V
R1 2K
PU1

SH 2 O/T SELECT

1

UR Ø
J49-20 +RD DATA Ø
J49-19 -RD DATA Ø

DR 1
J46-20 +RD DATA 1
J46-19 -RD DATA 1

DR Ø
J44-17 +R/W CLOCK Ø
J44-16 -R/W CLOCK Ø

DR 1
J46-17 +R/W CLOCK 1
J46-16 -R/W CLOCK 1

RP1 220
MC3486
U1
PU1

J44-9 B PHOTO Ø
J46-9 B PHOTO 1
J44-12 -PWR LOSS Ø
J46-12 -PWR LOSS 1

U37 LS10

U3 LS157

J44-18
J44-24
J44-15
J44-2
J46-2
J46-18
J46-24
J46-15

Y1 RDAT SH 1
Y2 RCLK SH 3
Y3 M PHOTO SH 5
Y4 -SEL PWR LOSS SH 2
ANY POWER LOSS SH 2

+5V
RP2 4.7K

SH 3 -WRITE GATE
SH 3 -RD GATE
SH 2 Z/12 VOLTS
SH 2 M STEP

U4 LS241 SEL DR Ø

-WR GATE Ø J44-14
-WR GATE 1 J46-14
-RD GATE Ø J44-13
-RD GATE 1 J46-13
Z/12 V Ø J44-5
Z/12 V 1 J46-5
STEP Ø J44-8
STEP 1 J46-8

SH 5 7.6 MHZ
U2 3487
P.U.

+25 MHZ Ø J44-26
-25 MHZ Ø J44-25
+25 MHZ 1 J46-26
-25 MHZ 1 J46-25

SH 1 WRITE DATA

+WR DATA Ø J44-23
-WR DATA Ø J44-22
+WR DATA 1 J46-23
-WR DATA 1 J46-22

P.U.1

SH 2 DIRECTION IN
SH 3 HAR 1
SH 3 HAR Ø

J44-7
J46-7
J44-10
J46-10
J44-11
J46-11

UNUSED GATES

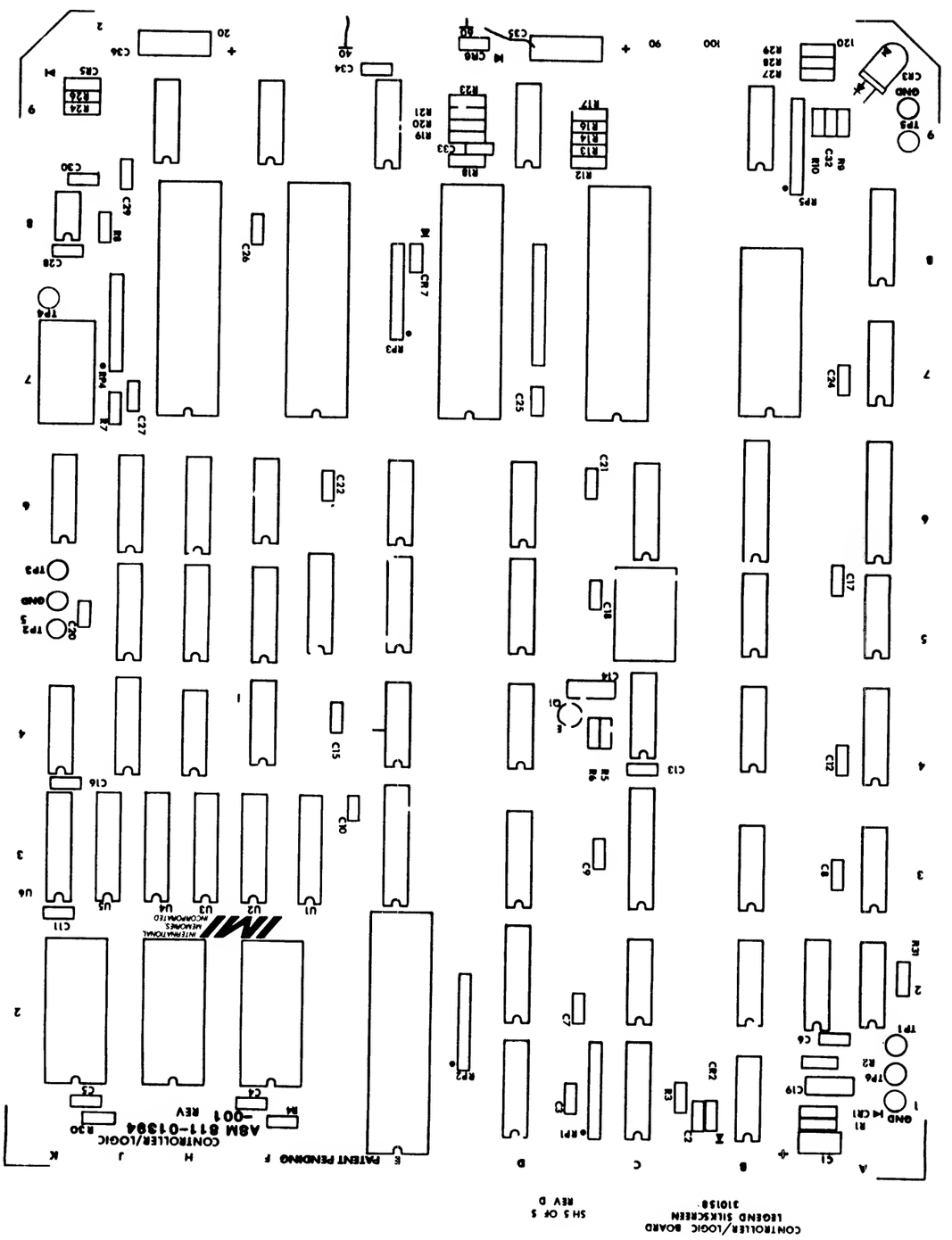
U54 74279
U16 LS32
U68, LS152
U24 LS08
U50 LS00
U37 LS10
U17 LS08
U52 LS04
U15 LS02
U27 LS04
U9 LS04

- ORIGINAL -

ENG'R. NO. 400037

MATERIAL	SCALE NONE	IMI INTERNATIONAL MEMORIES INCORPORATED
FINISH	DRN	5000 (PHASE III) CONTROLLER
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES	CHK DATE	D 263-00055-200 BB
DECIMAL .XX ± .XXX ±	FRACTIONAL ± ANGULAR ±	APPROVED DATE / RELEASED DATE
		SHEET 6 OF 6 REV.

DRAWING REORDER NO 1179


CONTROLLER/LOGIC BOARD
LEGEND SILKSCREEN
310158-
REV D
SH 5 OF 5
ASM 811-01394
-001 REV
CONTROLLER/LOGIC
PATENT PENDING
INTERNATIONAL
MICROMATICS
INCORPORATED

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REV	DATE	EC NO.
AA	10/6/81	324 JKS
BB	12/04/81	350 VP

REV	DATE	EC NO.

263-01556-00

NEXT ASSEMBLY	USED ON

+12 R43 2.7K R49 240 C 21 .01 R47 100Ω R48 240Ω L2 3.9uH C38 22 C37 120 L1 3.9uH C27 .1 R64 24K R75 470Ω C36 .1 R74 24K C28 .1 R42 100Ω C18 .1 CR13 IN5234 6.2V

+5 R63 100Ω

+12 R41 51Ω C33 .1 C29 10uF R62 51Ω U29 592 C32 150pF C31 .1 R 108 5.6K R 109 5.6K C30 .1

READ MON TP-18

R98 510 R97 1K R96 510 R80 510 R78 1K R95 510 R85 510 R81 510 R79 1K C48 .01 U27 116 R89 510 R88 510 R85 510 R84 510 R87 330 R86 330 R58 820 R57 820 C26 150pF Q8 2N5771 Q7 2N5771 +12V

U24 500 U18 S04 READ DATA SW 2 READ DATA SW 3

R55 270 R56 270

R5 510 U25 3046 R100 1K +12

TP-1 J31-11 DX R34 220Ω C15 .01 J31-12 DY R35 220Ω C 20 .01 R46 820Ω R 43 510Ω R44 820Ω TP-3 R 24 510 R 25 510

U17 CA3054

+12 R77 1K +5 R36 820Ω R76 3K C44 .01

+5 R95 3K R94 2K C53 .01 R99 470 U30 CA3046 R61 470Ω R50 3K R51 3K C23 .001 C22 .001 R59 100 C54 .1 R111 2.7K U28 741 AGC TP-9

+12 R27 20Ω Q-3 LM340 5V C11 1uF C14 .01 CR-5 IN5234 6.2V

TP14 "VCC"

CR-6 IN4001

VEE (-8V) J31-6
VCC (11.2V) J31-8
FALSE GND (+5.0V) J31-14
WR CURRENT J31-10

R30 2K CR12 HP2835 Q5 2N2222 Q4 2N2222 Q6 2N2222 R28 1.2K R31 121Ω 1% R33 12.1Ω 1%

+12 Q9 LM340 5V C16 .1 C17 .01 R39 680 R40 360 Q10 2N2222 R29 1.2K

TP16 "WC" TP17 "WS" (5.0 TO 8.5V) WR SELECT J31-5

+5V RP1 1K

TP15 "WG"

+5 R23 1.2K U16 S74 SH-3 ENCODED DATA RP-11K RP 7 -WRITE GATE J34-14 J36-14 WRITE DISABLE J34-6 J36-6 U2 3487 U8 LS14 R18 1.2K CR11 W

+ WRITE SH-3

SH-2 PWR LOSS

MATERIAL	SCALE	IMI INTERNATIONAL MEMORIES INCORPORATED
FINISH	DRAWN DATE	PHASE 4 R/W
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES: DECIMAL .XX ± .XXX ± FRACTIONAL ± ANGULAR ±	CHK. DATE / ENGR. DATE / APPROVED DATE / RELEASED DATE	D 263-01556-001 BB
		SHEET 1 OF 4 REV.

DRAWING NO. 1129

83

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REV	DATE	EC NO.
AA	10/6/81	324 MS
BB	82/02/26	350 VB

REV	DATE	EC NO.

263-01556-001

NEXT ASSEMBLY | USED ON

SEE SH 1 FOR REV.

P.S. VOLTAGE FAULT

+12V
R14 510Ω
CR4 1N5234 6.2V 2%
+6.7V
R10 18K
R11 24K
U12 339
R11 4.3K
+5V
R15 10K
R16 24K
+4.4V
+5V

SH-1
-PWR LOSS → J34-12 [5]
J36-12
READ → SH 3

ERROR AMP.
+12V
R53 4.3K
R54 4.3K
R68 2.7K
U25 CA3046
TP-11 ERROR VOLTAGE +6V ± 1V
R66 510
R67 510
C24 .001
C34 470pF
R65 51
R70 2.7K
R69 2.7K
R73 2.7K
R72 2.7K
R52 1.2K

+5V
R90 1.2K
H1
U21 374
U04 S04
H2
U19 LS74
-DATA SYNC TP-10
SH 1 READ DATA
U20 LS00
U23 S158
READ
VCO TP-6
TP5 RF
U04 S04
U24 S08
VCO (31MΩ)
R32 4.7Ω
C25 47pF
U24 S08
U24 S09
U24 S08

RP1
[5] J34-13 -READ GATE
J36-13
U19 LS14
U19 LS74
U20 LS00
[5] J34-26 7.6MHZ
J36-26
J34-25
J36-25
R3 220Ω
7.6MHZ
H3
U1 MC3486
U20 LS00
U19 LS14
READ GATE
CR10
U6 S74
U24 S08

VCO CLK → SH 3
VCO CLK → SH 3
VCO ENABLE → SH 3

CLK GENERATOR

MASTER

MATERIAL	N/A	IMI INTERNATIONAL MEMORIES INCORPORATED
FINISH	PENTECH 11/BB	PHASE 4, READ/WRITE
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES: DECIMAL .XX ± .XXX ± FRACTIONAL ± ANGULAR ±	DRAWN OKS 27SEP81	D 263-01556-001 BB
		SHEET 2 OF 4 REV.

THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF IMI AND ARE TO BE USED ONLY FOR THE PURPOSE OF MANUFACTURING PARTS FOR IMI.

REV	DATE	EC NO
AA	10/6/81	324 MS
BB	82/02/26	350 JB

REV	DATE	EC NO

263-01556-001

NEXT ASSEMBLY | USED ON

SEE SHT 1 FOR REV

ENCODER

+5V

R22 1.2K

Hz

Ø ENCODE

J36-23

J34-23 WR DATA

J34-22 WR DATA

J36-22

R6 220

U1 MC3486

H3

H2

U5 LS74

U6 LS00

U8 LS14

U13 S74

ENCODED DATA — SH 1

SH 1 +WRITE

1ENCODE

SPARE → J36-21
SPARE → J36-1
SPARE → J36-2
SPARE → J36-3
SPARE → J34-21
→ J34-15,18,24

7.6 Mz

U2 MC3487

+R/W CLOCK → J34-17, J36-17
-R/W CLOCK → J34-16, J36-16
+RD DATA → J34-20, J36-20
-RD DATA → J34-19, J36-19
→ J36-18,15,24

DECODER

H1

DECODE CLK TP-4

DECODE DATA TP-8

U15 S74

U14 S74

U13 S74

SH2 VCO CLK

SH2 VCO ENABLE

SH2 $\overline{\text{VCO CLK}}$

SH1 READ DATA

SH2 READ

MASTER

SCALE	N/A
DRAWN	PENTECH '81
CHK'D	
ENGR	MS 21 JAN 82
APPROVED	
RELEASED	

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES

DECIMAL .XX ± .XXX ± | FRACTIONAL ± | ANGULAR ±

IMI INTERNATIONAL MEMORIES INCORPORATED

PHASE 4, IMI, READ/WRITE

D 263-01556-001 BB

SHEET 3 OF 4 REV

85

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REV	DATE	EC NO.
AA		324
BB1		350

J36-5 / J34-5 Z/12 V — RP1 — U3 LS14 — U3 06 — R19 680 — R20 510 — R21 1.2K — 2N4032 Q2 — C42 .001 — R6 51 — R8 2.7K — C7 1.0 — 2N2222A Q1 — C8 10 — +12V — +5V

J36-8 / J34-8 STEP — U3 LS14

J34-7 DIRECTION IN / J36-7 — U3 LS14

U4 SAA1042 — FULL — R9 47K

COIL 1A → J31-1
COIL 1B → J31-2
COIL 2A → J31-3
COIL 2B → J31-4

J39-4 STEPPER DISABLE / J36-4 — U6 LS14 — U7 06

J37-1 +5V
J37-4 GND
J34-11
J36-11
J34-10
J36-10

HEAD SEL Ø — U3 LS14 — C50 .001 — C49 .001 — R26 1.8K — HSØ → J31-7
HEAD SEL 1 — U3 LS14 — R129 1.8K — HS1 → J31-13

+5 — R17 1.1K — R7 1.1K — R107 7.5K — R106 7.5K

CR8 IN4148 — CR7 IN4148 — R102 360 — R101 330

TP7 — C51 .001 — CR2Ø, HP2835 — R92 4.3K — C45 .1 — C52 .1 — R105 270 — U12 339 — R1 1.2K — R4 2.7K

B PHOTO → J34-9, J36-9

R104 4.3K — C56 .001 — R13 10K — R12 4.5K — R37 1.2K — U7 06

J31-18 Ø SENSE — U12 339 — TP13 "Ø"

U7 06 — TRACK ØØ → J36-2, J34-1

J37-3 DIODE I — R82 100
J31-17 DIODE I Ø — R38 100

J35-1 +12V → +12V — CR1 IN4001

J34-1,3 — J35-6 +5V → +5V — C2 10 — CR3 IN4001 — C1 .1 — C4 150µF — C5,6,9,10,12,13,41,46,47 .1

J35-2 GND → GND — TP2 — TP12

J31-16, 15 — C3 .1 — CR2 IN4001

J34-2 — J35-5 → -5V

J35-3 M+12V → M+12V → J38-3

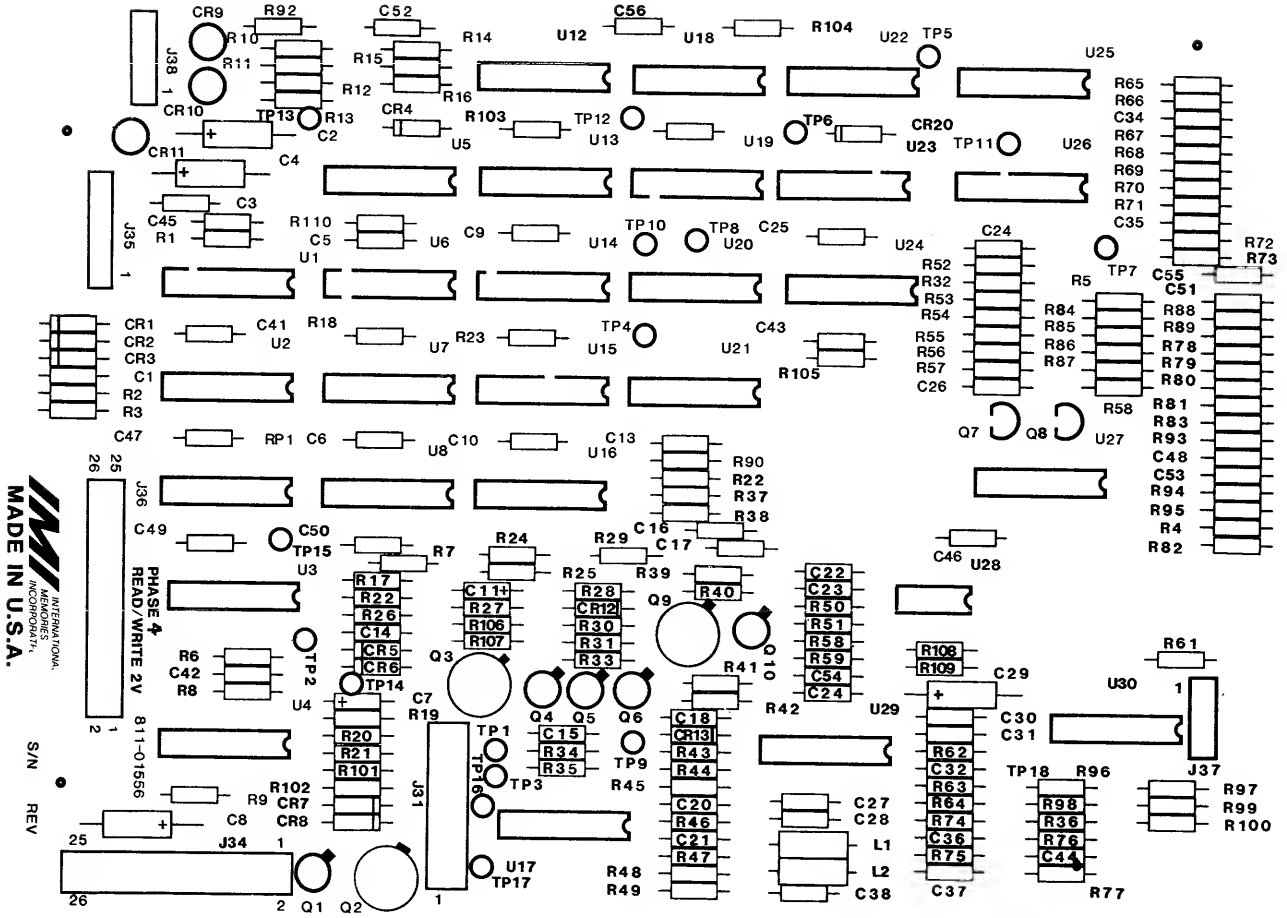
J35-4 M COM → M COM → J38-2

BRAKE → J38-1

J38 5

MASTER

MATERIAL	SCALE NONE	IMI INTERNATIONAL MEMORIES INCORPORATED
FINISH	DRAWN 1/22/80	PHASE 4, READ/WRITE
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES DECIMAL .XX ± .XXX ± FRACTIONAL ± ANGULAR ±	APPROVED	D 269-01556-001 BB
	RELEASED	SHEET 4 OF 4 REV.


MADE IN U.S.A.
INTERNATIONAL MEMORIES INCORPORATED
PHASE 4
READ/WRITE 2V
811-01556
S/N
REV
J38
J35
J36
J34
J31
J37
CR9
CR10
CR11
R92
R10
R11
R12
C52
R14
R15
R16
C56
U12
U18
R104
U22
TP5
U25
TP13
R13
C2
C4
CR4
U5
R103
TP12
U13
U19
TP6
CR20
U23
TP11
U26
C3
C45
R1
R110
C5
U6
C9
TP10
U14
TP8
U20
C25
U24
C24
U1
R52
R32
R53
R54
R55
R56
R57
C26
TP7
R5
C55
C51
R65
R66
C34
R67
R68
R69
R70
R71
C35
R72
R73
R84
R85
R86
R87
R58
R88
R89
R78
R79
R80
R81
R83
R93
C48
C53
R94
R95
R4
R82
CR1
CR2
CR3
C1
R2
R3
C41
U2
R18
U7
R23
TP4
U15
C43
U21
R105
Q7
Q8
U27
C47
RP1
C6
U8
C10
C13
U16
R90
R22
R37
R38
C16
C49
C50
TP15
U3
R7
R24
R29
C17
R25
R39
R40
C46
U28
R17
R22
R26
C14
CR5
CR6
C11
R27
R106
R107
R28
CR12
R30
R31
R33
Q9
Q10
R41
R42
C22
C23
R50
R51
R58
R59
C54
C24
U29
R108
R109
C29
C30
C31
R61
U30
R6
C42
R8
TP2
TP14
U4
C7
R19
Q3
Q4
Q5
Q6
TP1
C15
R34
R35
TP9
R45
C18
CR13
R43
R44
C20
R46
C21
R47
R48
R49
R62
C32
R63
R64
R74
C36
R75
C37
TP18
R96
R98
R36
R76
C44
R77
R97
R99
R100
R20
R21
R101
R102
R9
CR7
CR8
C8
TP16
TP3
C27
C28
L1
L2
C38
U17
TP17
Q1
Q2

SILKSCREEN

NO.	DATE	BY	263-01948 -000
AA	3-20-82	382	

NOTES UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS (Ω), 1/4W, 5%
2. ALL CAPACITORS ARE MICROFARADS (uF)
3. ALL SN74*X SERIES I.C.'S
   - A. 14 PIN - PIN 14 = +5V, PIN 7 = GND
   - B. 16 PIN - PIN 16 = +5V, PIN 8 = GND
   - C. 20 PIN - PIN 20 = +5V, PIN 10 = GND

[4] MK4118 (1K x 8 RAM) IS CUSTOMER INSTALLED OPTION ONLY.

RP5 4.7K

RP3 4.7K

RP5 4.7K

U67 LS245

U55 2114 L RAM (1K x 4)

U56 2114 L RAM (1K x 4)

U57 2114 L RAM (1K x 4)

U58 2114 L RAM (1K x 4)

U59 2114 L RAM (1K x 4)

U60 2114 L RAM (1K x 4)

U47 Z80A CPU

U24 LS08

U48 LS138

U62 LS08

U31 2716 (2K x 8)

U32 2716 (2K x 8)

U33 2716 (2K x 8) OR [4]

U25 LS11

U41 LS164

U40 LS374

U39 LS166

U26 LS04

U35 LS54

U34 LS74

U36 9401

U50 LS00

U42 74

R17 470Ω

C64 .1

C63 10

C2-C13 .1

C15, C18 .1

C20-C22 .1

C1, C14, C16, C17, C19, C23-C57, C61, C64 .1

C67 10μF

C68 .1

INTERRUPT
DSK WAIT
EXT WAIT
NMI
RESET
RAM BUS ENABLE
WR DSK/MEM
WR EXT/MEM
MEMORY ENABLE
DISK→MEM.
-WRITE GATE
EOB
-RD GATE
HEADER/DATA
RDAT
SH3 CLOCK
SH3 CLKEN
SH3, DSP
-CLOCK
EOB

RAM BUS SH4
DATA BUS SH2,3
ADDRESS BUS SH2,3,4
Y4 SH4
Y3/5 SH4
A10
RAM JUMPER
ROM JUMPER
+5V
RAM JUMPER
ROM JUMPER
SYSTEM CONTROL BUS SH4
MREQ SH4
QA (SH3)
CRC ERROR SH2
WRITE DATA SH6

[5]
-001	CL66 IS: 47PF
-002	CL66 IS: 120PF

-MASTER-

IMI INTERNATIONAL MEMORIES INCORPORATED

5007 CONTROLLER

D 263-01948 -000 AA

1 1 6

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REV	DATE	EC NO
AA	3.20.82	382

263-01948-000

NEXT ASSEMBLY | USED ON

+5V
Z4 VDD
ZC/TO0 CLK/TRG1 ZC/TO1 CLK/TRG2 CLK/TRG3 CLK/TRG0 RESET
U23 LS04
U116 LS32
U53 279
U130 IEO Z80A-CTC INT M1 IORQ RD GND
U22 LS138 G2B C B A G2A G1 Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7
U23 LS04
ZC/TO2

SH5 INDEX
SH5 SECTOR
SH4 RESET

SH1 DATA BUS
SH1 ADDRESS BUS
SH1 SYSTEM CONTROL BUS
SH3 Ø

MEMORY ENABLE SH1
NMI SH1
DIO3 CE SH3
BEGRDY SH4
H3XCLR SH4
XFERSTB SH4
INTERRUPT SH1,4

U45 U44 Z80A-PIO (0) (2)
RP4 1K
RP5 4.7K
J46-2 DITRØØ
SH1 CRC ERROR
19 -WR PROTECT 1
18 -WR PROTECT Ø
J44-2 DØTRØØ
U64 07
R12,120
R13 120
CR4

-SELECTED PWR LOSS SH-6
+ ANY PWR LOSS SH-6
H3XSTB SH-4
PIO SH-3

U64 07
R4 4.7K
R21 4.7K
R5 1.2K
R6 1.2K
R7 4.7K
R8 4.7K
RP3,4.7K
U116 LS32

105 -COMPL
109 -ALT SEL
110 -DRV. ACK
111 BUS DIR
105 -SYNC
H3XFER SH4
PIO RDY SH4
STROBE SH4
81 -STROBE

93 DATA BIT Ø
96 DATA BIT 1
97 DATA BIT 2
98 DATA BIT 3
99 DATA BIT 4
100 DATA BIT 5
101 DATA BIT 6
102 DATA BIT 7
COMMAND BUS SH 4
Ø/1 SELECT SH-6
5/12 VOLTS SH-6
H3STB SH-6
DIRECTION IN SH-6
17 ACTIVITY LED

— MASTER —

MATERIAL	SCALE NONE
FINISH	DRAWN MIKE 4-21-81
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES DECIMAL XX ± XXX ± FRACTIONAL ± ANGULAR ±	CHKD / ENGR / APPROVED / RELEASED

IMI

5007 CONTROLLER

D 263-01948-000 AA

SHEET 2 OF 6 REV

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REV	DATE	EC NO
AA	3-20-82	582

REV	DATE	EC NO

263-01948-000

NEXT ASSEMBLY	USED ON

-RXD 5 — CR2 IN4148 — R15, 390Ω — R16, 270Ω

PIO SH-2

-R/W DISABLE 1 → J46-6
-R/W DISABLE Ø → J44-6
HAR 1 → SH-6
HAR Ø → SH-6

STEPPER DISABLE 1 → J46-4
STEPPER DISABLE Ø → J44-4

-TKØ
COM

TP2 -WRITE GATE → SH-1,6
TP6 -READ GATE → SH-1,6

RP3, 4.7K — +5V

FORMAT ENABLE 12
OPTION SELECT
TIME OUT DISABLE
SECTOR SIZE 1
SECTOR SIZE Ø
1K SI

SH-2 PIO3CE

U46 Z80A-PIO (3)

R19, 4.7K — R18, 4.7K — +5V

R14, 100 — +5V — K20, 100 — Q2 2N222A

U51 — U52

UNIT SELECT — 1K SI

SH1 ADDRESS BUS
SH1 DATA BUS
SH1 SYSTEM CONTROL BUS
-UNIT SELECT 1
-UNIT SELECT 2
-UNIT SELECT 3
SYSTEM/DIAG

SH4 MEM→DISK
SH4 DISK→MEM

SH4 XRD SH-4 XFERBYTE
SH4 XFEREND

U54 279 — U42 LS74 — U37 LS10 — U43 LS32 — U45 LS32

U25 LS11 — U65 LS32 — U45 LS32

U59 S74 — Q1 2N3640 — R2 330 — C62 68pF — R3, 1.5K

U29 LS74 — U45 LS32

U28 LS153 — U26 LS04

SH4 RESET
SH-5 5.12 MHZ
SH-6 RCLK

PU2 — U10 — U18 — U17 — U12 — RP4 1K — U13 LS174 — U15 LS08 — U27 LS04

PST SH1
CLKEN SH1
WR DSK/MEM SH1
HEADER/DATA SH1
EOB SH1
DSK.WAIT SH1
EOB SH-1

U19 LS165 — U20

CLOCK SH1
Ø SH1,2,4
-CLOCK SH-1

RP4 1K — +5V — PU3 PU2

- MASTER -

MATERIAL	SCALE NONE	IMI
FINISH	DRAWN MIKA'FLE 2/17/80	5007 CONTROLLER
	CHKD	D 263-01948-000 AA
	ENGR	SHT 3 OF 6

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REV	DATE	EC NO
AA	3-20-82	382

REV	DATE	EC NO

263-01948-000

NEXT ASSEMBLY	USED ON

SH2 PIO RDY
SH2 HSXFER
SH2 XFERSTB
SH2 STROBE
SH3 Φ
SH2 HSXCLR
SH2 INTERRUPT
SH2 BEGRDY
COMMAND BUS SH2
SH1 Y4 MREQ
SH1 Y9/5
SH1 ADDRESS BUS
- SYS. RST.
SYSTEM CONTROL BUS SH1

U68 LS132 R11, 620 U68 LS132 C66, 5
U70 LS74
U62 LS08
U61 LS74
U61 LS74
U62 LS08
U53 LS279
U53 LS279
U53 LS279
CR1 HPS082-2835
U62 LS08
U38 S74
U49 LS156
RP4, 1K +5V
U50 LS00
R10 10K CR5 IN4148 C59 2.2μf LS132 1K8
RP5 4.7K R9, 100 C65 .01
LS374, U65
U66, LS373
LS164 U69 CLR
LS04 1152
LS04 U52
U11C LS74
U63 LS32
U24 LS08
U25 LS11
U16 LS32
U50 LS00
U64 07
RP4 1K +5V
U63 LS32
U63 LS32

93 RDY
HSXSTB SH-2
XFERBYTE SH-3
EXT WAIT SH1
WR EXT/MEM SH1
XFEREND SH3
RAM BUS SH1
DISK-MEM SH1,3
XMD SH3
MEM-DISK SH3
RAM BUS ENABLE SH1
RESET SH1,3
SYSTEM CONTROL BUS SH2,3

MASTER

MATERIAL	SCALE NONE	IMI
FINISH	DRAWN MIKE 1-27-81 DATE	5007 CONTROLLER
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES TOLERANCES	CHD DATE	D 263-01948-000 AA
DECIMAL XX ± XXX ±	ENGR DATE	SHEET 4 OF 6 REV
FRACTIONAL ANGULAR ±	APPROVED DATE	
	RELEASED DATE	

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REV	DATE	EC NO
AA	3-6-86	382

263-01948-000

7.5 MHZ — SH-6

-5V

U5 15.36 MHZ

U6 LS393 — U6 LS393 — U7 LS393 — U7 LS393

U23 LS04

U14 LS74

U15 LS02 — U27 LS04 — SECTOR — TP4 — SH-2

U16 LS02 — U27 LS04 — INDEX — TP3 — SH-2

U21 LS92

195 ns

5.12 MHZ — SH-3

SH-4 RESET

U8 LS74 — U8 LS74 — U14 LS74

PU1

TP8

TP9

TP10

TP1

SH-6 M PHOTO

U9 LS04

MASTER

MATERIAL	SCALE: NONE	IMI
FINISH	DRAWN: MIKE 4-22-87	5007 CONTROLLER
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS: INCHES TOLERANCES DECIMAL XX ± XXX ± FRACTIONAL ± ANGULAR ±	CHD DATE; ENGR DATE; APPROVED DATE; RELEASED DATE	D 263-01948-000 AA; SHEET 5 OF 6 REV

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REV	DATE	ECO NO.
AA	3-30-82	382

263-01948-000

+5V
R1
.2K
PU1

SH 2 O/T SELECT

1
DR 0 J49-20 +RD DATA 0
J49-19 -RD DATA 0
DR 1 J46-20 +RD DATA 1
J46-19 -RD DATA 1
DR 0 J49-17 +R/W CLOCK 0
J44-16 -R/W CLOCK 0
DR 1 J46-17 +R/W CLOCK 1
J46-16 -R/W CLOCK 1

RP1,220
U1 MC3486
PU1
PU1

U3 LS157
SEL A
G
A_1 B_1 A_2 B_2 A_3 B_3 A_4 B_4
Y_1 Y_2 Y_3 Y_4

RDAT SH 1
RCLK SH 3
M PHOTO SH 5
-SEL PWR LOSS SH 2
ANY POWER LOSS SH 2

J44-9 B PHOTO 0
J46-9 B PHOTO 1
J44-12 -PWR LOSS 0
J46-12 -PWR LOSS 1

U37 LS10

+5V
RP2 4.7K

J44-15
J44-24
J44-15
J44-2
J46-2
J46-11
J46-24
J46-15

SH 3 -WRITE GATE
SH 3 -RD GATE
SH 2 1/2 VOLTS
SH 2 M STEP

U4 LS241
SEL DR 0

-WR GATE 0 J44-14
-WR GATE 1 J46-14
-RD GATE 0 J44-13
-RD GATE 1 J46-13
1/2 V 0 J44-5
1/2 V 1 J46-5
STEP 0 J44-8
STEP 1 J46-8

P.U.
SH 5 7.6 MHZ
U2 3487

+7.5 MHZ 0 J44-26
-7.5 MHZ 0 J44-25
+7.5 MHZ 1 J46-26
-7.5 MHZ 1 J46-25

SH 1 WRITE DATA
+WR DATA 0 J44-23
-WR DATA 0 J44-22
+WR DATA 1 J46-23
-WR DATA 1 J46-22

P.U.1

SH 2 DIRECTION IN
SH 3 HAR 1
SH 3 HAR 0

J44-7
J46-7
J44-10
J46-10
J44-11
J46-11

UNUSED GATES

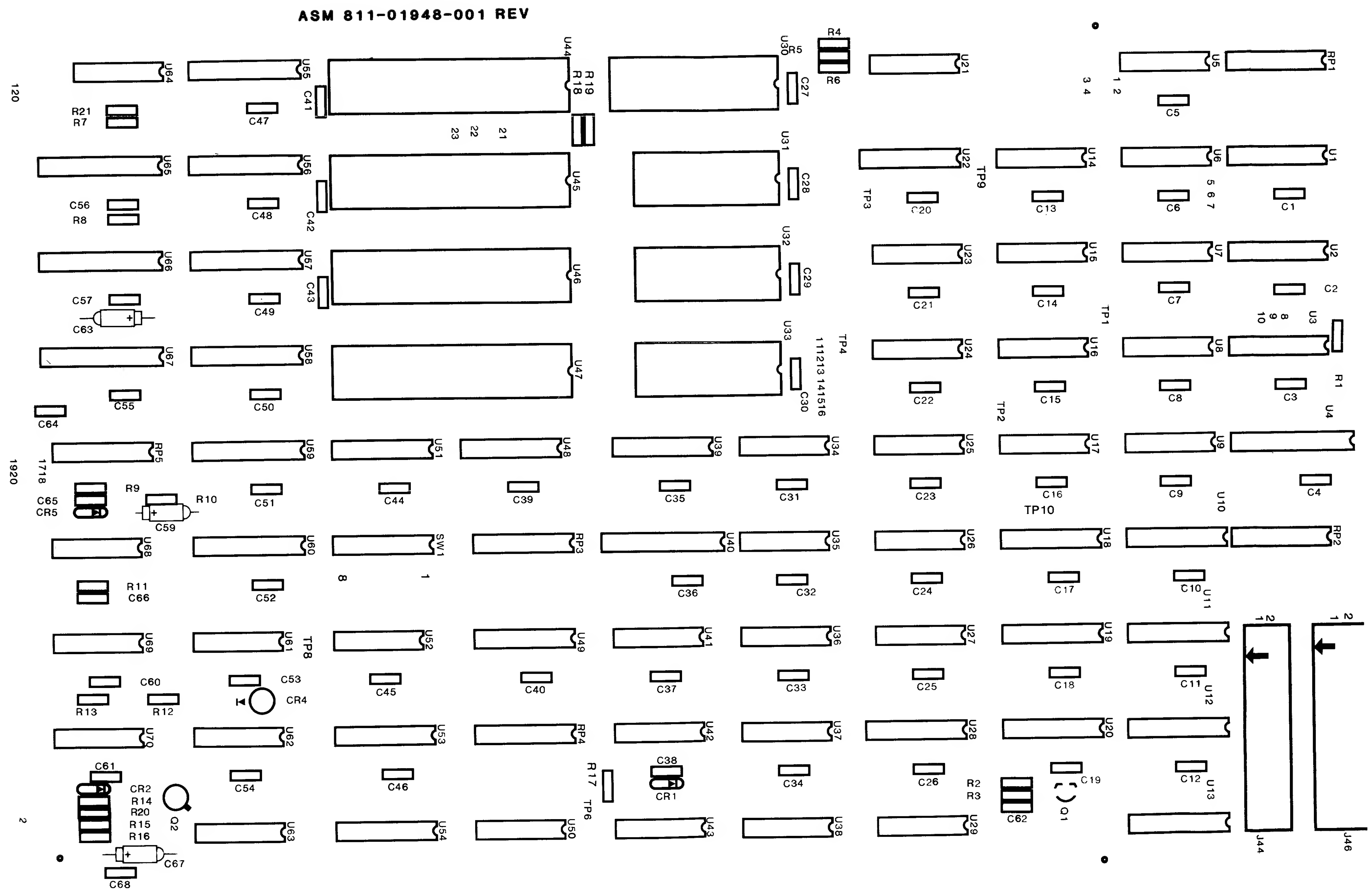
U54 74279
U16 LS32
U68 LS132
U24 LS08
U50 LS00
U37 LS10
U17 LS08
U52 LS04
U15 LS02
U27 LS04
U9 LS04

- MASTER -

MATERIAL	SCALE NONE
FINISH	DRAWN THE CISCO KID 1-20-82
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS IN INCHES TOLERANCES	CHK'D DATE
DECIMAL XX ± .01 XXX ± .005	FRACTIONAL ANGULAR ±
	APPROVED DATE
	RELEASED DATE

IMI
5007 CONTROLLER
D 263-01948-000 AA
SHEET 6 OF 6 REV

93



ASM 811-01948-001 REV
U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20
U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40
U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60
U61 U62 U63 U64 U65 U66 U67 U68 U69 U70
RP1 RP2 RP3 RP4 RP5
C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20
C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33 C34 C35 C36 C37 C38 C39 C40
C41 C42 C43 C44 C45 C46 C47 C48 C49 C50 C51 C52 C53 C54 C55 C56 C57 C59 C60
C61 C62 C63 C64 C65 C66 C67 C68
R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21
CR1 CR2 CR4 CR5
Q1 Q2
SW1
J44 J46
TP1 TP2 TP3 TP4 TP6 TP8 TP9 TP10
120 1920 1718 2 21 22 23 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

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REV	DATE	EC NO.
X1		
X2		
X3		

REV	DATE	EC NO.	400017
			NEXT ASSEMBLY / USED ON

P34-14
P34-11
+12V
R38 200
C48 .01
R37 240
R43 240
L2 3.9uh
C35 0.1
C31 120pf
R29 470
R32 2.4K
R33 24K
C34 150pf
R31 512
C36 0.1
C45 22 pf
L3 3.9uh
U18 NE592
C105 1.0µf
C43 0.1
SIG TP
R35 2K
C42 0.1
C44 .1
C30 0.1
CR7 6.2V IN5234
R36 2K
R28 200
-12V
SH-2 +6V
RG5 200
RG6 200
R63 30
C67 500pf
CR16
C57 .1
Q11 2N2907
R49 510
R81 1K
R105 1K
C62 .01
R50 510
R53 510
R54 510
R52 510
R51 510
R47 1K
R48 1K
C41 .01
U17 10116
U10 10107
C33 150pf, 10%
xDET TP
E -516 (SHEET 3)
RP8 510
RP4 510
-5V
C49 0.1
TP AGC
R64 91
C81 .001, 10%
R99 3K
C63 .01
R86 270Ω
R89 3.3K
+12V
R95 100
C66 .01
U25 741
C65 .01
R89 100
C60 .001 10%
R104 3K
U30 CA3046
R90 4.3K
R115 4.3K
C68 .01
R100 100
C73 .01
R92 1K
P33-8 DY
P33-7 DX
U 23 CA3054
R39 220
R40 220
C46 .01
R45 146
R41 1.5K 1%
R42 1.5K 1%
C47 0.1
R44 200
LO SIG. TP-Y TP-X
Q6 2N2222A
Q5 2N2222A
R62 200
CR10
R46 1K
RECORD DATA 2 (SHEET 3) A
RECORD DATA B (SHEET 3)
WRITE DRIVE C (SHEET 2)
J35-5 +5V
J35-4 -5V
J35-2 -12V
J35-1 +12V
J35-3 GND
R118 27
C76 10 uf
C17 2.2

BYPASS CAPS

+12V	-12V	+5V	-5V
C7, 18, 30, 66, 69, 77	C15, 21, 29, 55, 56, 64, 70, 82	C12, 32, 51, 67-72, 83	C9, 16, 28, 74-76, 78-83, 85-93, 105

CONNECTOR	SIG. NAME
J33 -9	HEAD GND
-6	WRITE UN
-3	+6V DC
-1	-4V DC
-2	WRITE SELECT
-5	WRITE CURRENT
-4	-HEAD SEL Ø
-10	-HEAD SEL 1
-8	DX
J33 -7	DY
J34 -1	-SYS. CLOCK
-2	+READ DATA
-3	+SYS. CLOCK
-4	-READ DATA
-7	-READ GATE
-10	+WRITE DATA
-12	7.68 MHZ CLOCK
-13	-WRITE GATE
-9	-WRITE DISABLE
-6	+HAR Ø
-8	+HAR 1
J34-5	-FAULT

NOTES

1. ALL 510 Ω RESISTORS ARE CTS SIP RESISTOR NETWORKS, CTS P/N 750-61-R510 Ω.
2. ALL DIODES IN4148.
3. LAST USED REF. DESIG. R109, L10, C105, CR17, Q12, RP14.
4. ALL CAPS IN µFD UNLESS OTHERWISE LABLED.
5. NOT USED, R60, 61, 66, 102; L1-7; 49, 52, 63; CR4; C2.

PHASE 1

	NONE	IMI INTERNATIONAL MEMORIES, INCORPORATED
	S. WEBB	SCHEMATIC READ WRITE PCB 4V
		D 400017 X4
		SHEET 1 OF 3 REV.

DI-LINE REORDER NO. 1139

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REV	DATE	EC NO.
X1		
X2		
X3		
X4		

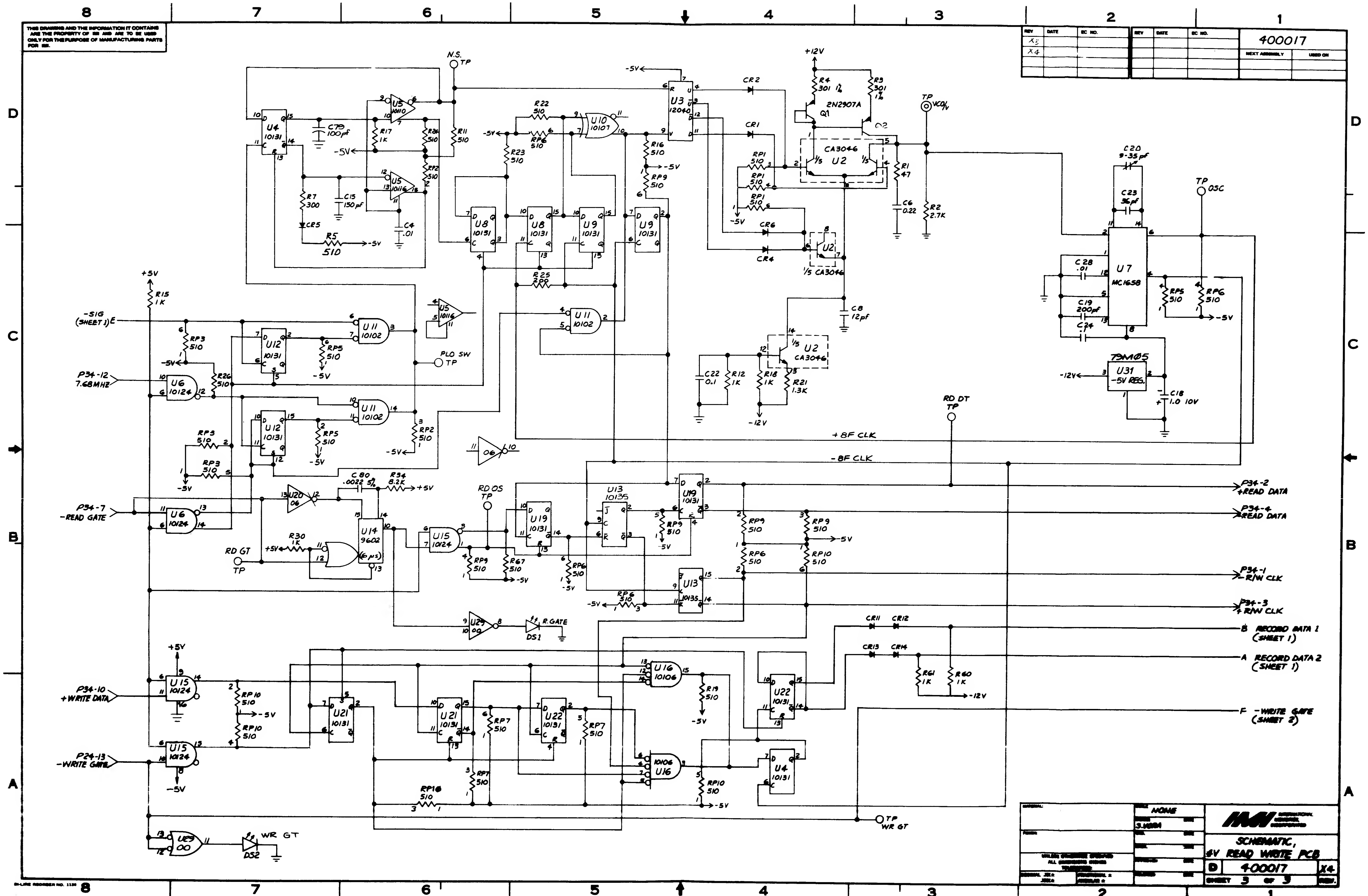
REV	DATE	EC NO.

400017

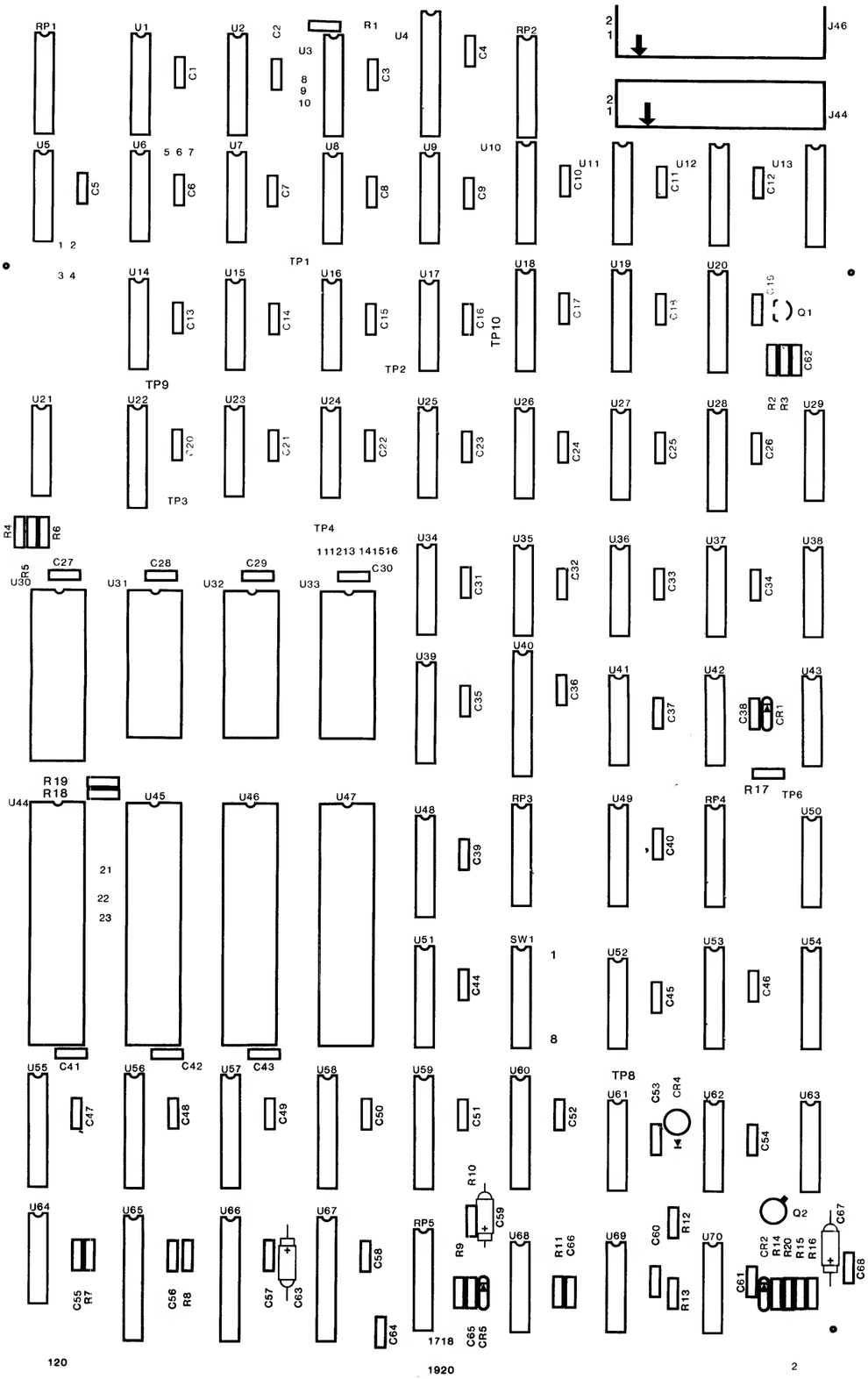
NEXT ASSEMBLY	USED ON

Q12 HEAT SINK
REG +6V
C78 0.1
+12V
-12V
+5V
-5V
TP +6VDC
TP -6VDC
Q13 2N2905
1180 1% R119
C75 4.7µF
R120 806 1%
C74 4.7µF
R116 2.4K
R106 100
C84 .001
R97 51
R110 47
R93 1K, 1%
Q9 2N2219
R101 150
U26 CA3046
C72 200pF
R111 1.3K
R107 560
R102 620
R71 150
R72 3.32K 1%
R76 3.32K 1%
C59 .01
R77 1.5K
U24 339
R69 1K
R74 3.32K, 1%
R70 1.8K
R75 1K
R73 1.8K
Q10 2N2905
R79 1100
Q8 2N2219A HEAT SINK
Q7 2N2907
R78 1300
R84 240
R85 240
R55 68
Q4 2N2905
R56 51
C50 1.0
R59 270
U20 06
R57 2K
SPARE
HEAD GND
+6V
SH1
P33-3 PREAMP +6V
P33-1 PREAMP -4V
(W = 3.5V)
P33-2 WRITE SEL
(W ≈ -4V)
C WRITE DRIVE (SHEET ONE)
(W ≤ -3V)
P33-5 WRITE. MA
P33-9
- WRITE GATE (SHEET 3)
F
P34-9 - WRITE DISABLE
P34-6 + HAR Ø
P34-8 + HAR 1
R13 1K
U27 10124
RP11 510
-WRITE DISABLE
SH-3
P33-4 -HD. SEL Ø
P33-10 -HD. SEL 1
R117 22.1K 1%
R114 16.2K 1%
R112 6.34K 1%
R108 16.2K 1%
C61 .1
CR18 8.2V 1%
R87 110Ω
R94 16.2K 1%
R91 9.09K 1%
R96 6.9K 1%
R103 9.09K 1%
U28 339
-8.2V
FAULT = -12V
R88 5.3K
R82 10K
CR19 1N6148
C64 .1
U29 00
U20 06
DS3
PWR LOSS
R10 4.7K
P34-5 -R/W FAULT OR -PWR LOSS
P33-6 WRITE UNSAFE (FROM 331 104)
(L 10 mA = UNSAFE)

MATERIAL	SIZE NONE	IMI INTERNATIONAL MEMORIES, INCORPORATED
FINISH	S.HORA DATE	SCHEMATIC READ WRITE PCB 4V
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES. TOLERANCES: DECIMAL .XX ± .XXX ± FRACTIONAL ± ANGULAR ±		D 400017 X4
		SHEET 2 OF 3 REV.



SCHEMATIC,
6V READ WRITE PCB
400017
SHEET 3 OF 3
NONE
X4
-SIG (SHEET 1)
P34-12 7.68MHZ
P34-7 -READ GATE
P34-10 +WRITE DATA
P24-13 -WRITE GATE
P34-2 +READ DATA
P34-4 -READ DATA
P34-1 -R/W CLK
P34-3 +R/W CLK
B RECORD DATA 1 (SHEET 1)
A RECORD DATA 2 (SHEET 1)
F -WRITE GATE (SHEET 2)
+8F CLK
-8F CLK
U7 MC1658
U31 -5V REG.
79M05
CA3046
2N2907A
U14 9602
RD GT TP
WR GT
R. GATE
WR GT
DS1
DS2
PLO SW TP
N.S. TP
RD DT TP
RD OS TP
TP OSC
TP VCO


RP1
U1
U2
C2
U3
R1
U4
RP2
J46
J44
C1
C3
C4
U5
U6
U7
U8
U9
U10
U11
U12
U13
C5
C6
C7
C8
C9
C10
C11
C12
TP1
U14
U15
U16
U17
U18
U19
U20
C13
C14
C15
C16
C17
C18
C19
Q1
C62
TP2
TP10
TP9
U21
U22
U23
U24
U25
U26
U27
U28
U29
C20
C21
C22
C23
C24
C25
C26
R2
R3
TP3
TP4
R4
R6
R5
C27
C28
C29
C30
U30
U31
U32
U33
U34
U35
U36
U37
U38
C31
C32
C33
C34
U39
U40
U41
U42
U43
C35
C36
C37
C38
CR1
R17
TP6
R19
R18
U44
U45
U46
U47
U48
RP3
U49
RP4
U50
C39
C40
21
22
23
U51
SW1
U52
U53
U54
C44
C45
C46
TP8
U55
C41
U56
C42
U57
C43
U58
U59
U60
U61
C53
CR4
U62
U63
C47
C48
C49
C50
C51
C52
C54
R10
U64
U65
U66
U67
RP5
U68
U69
U70
Q2
C67
C55
R7
C56
R8
C57
C63
C58
C64
R9
C59
C65
CR5
R11
C66
C60
R12
R13
CR2
R14
R20
R15
R16
C61
C68
1718
120
1920
2

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REV	DATE	EC NO.
BB		270

REV	DATE	EC NO.

263-01528-001

NEXT ASSEMBLY	USED ON
	5007

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS (Ω), 1/4W, 5%
2. ALL CAPACITORS ARE MICROFARADS (uf)
3. ALL SN74-X SERIES I.C.'S:
   - A. 14 PIN - PIN 14 = +5V, PIN 7 = GND
   - B. 16 PIN - PIN 16 = +5V, PIN 8 = GND
   - C. 20 PIN - PIN 20 = +5V, PIN 10 = GND

RP3 RP2 +5V 4.7K

R2 4.7K R4 4.7K

Z80 CPU 1E

3E LS245 DIR

3H 2114-L RAM (1K×4)

3H 2114-L RAM (1K×4)

3F 2114-L RAM (1K×4)

3J 2114-L RAM (1K×4)

2E/F 2114-L RAM (1K×4)

2K 2114-L RAM (1K×4)

1D LS138

1E LS08 1B

1E LS08 GE

1B LS11 4B

2F 2716 (2K×8)

2H 2716 (2K×8) OR MK 2118 (1K×8 RAM)

ROM BUS
DATA BUS
ADDRESS BUS
V4
V3/5

RAM JUMPER
ROM JUMPER
+5V
RAM JUMPER
ROM JUMPER

SYSTEM CONTROL BUS

INTERRUPT
DSK WAIT
EXT. WAIT
NMI
Φ
RESET
RAM BUS ENABLE
WR DSK/MEM
WR EXT/MEM
DSK→MEM
WRITING
+5R
SH-3 EOB

+READ DATA (77)
-READ DATA (78)
HEADER/DATA

R17 240 R16 160 R14 160 R13 240 R12 330

75107

3A LS74

2A LS74

2B LS54

5B LS00

2C LS164

3C LS374

3D LS166

2A/B LS132

3B 9401

4E LS04

5F LS04

-WA

CRC ERROR

(19) -WRITE DATA

C33 .1 -5V

C35 10 C36 10 C2-C13 .1 C15-C22 .1 C24-27,C29,C32,C34 .1 +5V

C30 .1 C28 .1 +12V -12V

CLOCK
CLKEN
PST

SH-3 EOB TO 6J-12 AND 5J-11

MATERIAL: MFG FROM EXISTING CONTROLLER/LOGIC BD FAB B, 310159	SCALE: -	IMI INTERNATIONAL MEMORIES INCORPORATED	
FINISH	DRAWN DATE	PHASE 1 CONTROLLER/LOGIC	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES:	CHD DATE		
DECIMAL .XX ± .XXX ± FRACTIONAL ± ANGULAR ±	APPROVED 6/1/81 DATE	D 263-01528-001	BB
	RELEASED DATE	SHEET 1 OF 4	REV.

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REV	DATE	EC NO.
BB		270

REV	DATE	EC NO.

263-01528-001

NEXT ASSEMBLY	USED ON
	5007

-WR DISABLE 53
-WR PROTECT 1 15
-WR PROTECT Ø 13

INDEX 64
SECTOR 61
RESET

DATA BUS
ADDRESS BUS
SYSTEM CONTROL BUS
Ø

FAULT 65
CRC ERROR
+TRG VELOCITY 52 NOT USED
OGB NOT USED
-POS OFF TRACK 30 NOT USED
-NEG OFF TRACK 51 NOT USED

NOT USED
+ON TRACK 29

-PWR LOSS 54
NOT USED 75 NOT USED
HSXSTB

45 +CYL EVEN
46 +TRACK SEEK
47 -SERVO DISABLE
43 -FWD VELOCITY
44 -REV VELOCITY
48 -DIFF 128
32 -DIFF 64
39 -DIFF 32
40 -PWR STEPPER DOWN
33 STEPPER Ø 3
38 STEPPER Ø 2
37 STEPPER Ø 1
36 STEPPER Ø Ø

MEMORY ENABLE
NMI

INTERRUPT
PIO 3 CE
BEGRDY
HSXCLR
XFERSTB

106 -COMPL
109 -ALTSEL
110 -SEL.ACK
11 BUS DIR
PIO RDY

105 -SYNC
HSXFER

STROBE
91 -STROBE

95 DATA BIT Ø
96 DATA BIT 1
97 DATA BIT 2
98 DATA BIT 3
99 DATA BIT 4
100 DATA BIT 5
101 DATA BIT 6
102 DATA BIT 7
DATA BIT BUS

35 -REV OFFSET
34 -FWD OFFSET
24 +POSIT MODE
73 -FAULT CLEAR
19 ACTIVITY LED
PWR LOSS SH-1,3,

TP4

MATERIAL	SCALE	IMI INTERNATIONAL MEMORIES INCORPORATED
SEE SHEET 1	NONE	
FINISH	DRAWN MIKA'ELE 2-9-80	PHASE 1 CONTROLLER LOGIC
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES	CHECKED	D 263-01528-001 BB
DECIMAL XX ± .XXX ± FRACTIONAL ± ANGULAR ±	APPROVED R2B JWM	SHEET 2 OF 4 REV.
	RELEASED	

DI-LINE REORDER NO. 1120

100

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REV	DATE	EC NO.
BB		270

REV	DATE	EC NO.

263-01528-001

NEXT ASSEMBLY	USED ON
	5007

PWR LOSS
-RXD 5
CR5 IN4148
R26, 390Ω
R24, 2700Ω
CR6, IN4148
CR7 IN4148
5 RP3 4.7K
+5V
RP4, 4.7K
R7 4.7K
FORMAT PROTECT 12
OPTION SELECT
BOOT ENABLE
SECTOR SIZE 1
SECTOR SIZE Ø
1K S1
PIO 3 CE
PIO (3) 7H
+5V 26
825123 2D
ADDRESS BUS
DATA BUS
SYSTEM CONTROL BUS
UNIT SELECT 1 4
UNIT SELECT 2 6
UNIT SELECT 3 8
UNIT SELECT 4 10
QA
MEM→DISK
DISK→MEM
XND
XFERBYTE
XFEREND
LS11 4B
LS32 7A
LS32 4C
LS14 4F
279 5D
279 5D
4E
R8, 1K
+5V
LS74 4D
Q1 2N3640
C14 68pf
R6 330
R5, 1.5K
RESET
+5V
Vcc 5C 5MHz OSC. GND 7
JUMPER
R23 160
R18 160
R20 330
R21 240
R19 240
-5V
+R/W CLK 80
-R/W CLK 79
9D 75108
R22 330
LS153 6C
LS74 6D
LS74 6D
LS00 5B
+PLO CLK 56 NOT USED
+SYNCH CLK 55 NOT USED
LS32 6F
LS32 6F
LS00 5B
LS32 6F
LS32 6F
+5V
R30 1K
825129 5H
LS163 6H
825129 6J
825123 5H
LS174 5J
LS08 6E
LS04 9F
LS74 4F
825129
NOT USED
LS164 4H
825129
LS74 4F
4E
LS04
TP3
TP5
+12V
TS150P 8K
-12V
63 - R/W DISABLE
18 + HAR 2
26 + HAR 1
23 + HAR Ø
50 - READ GATE
25 - STROBE EARLY
57 - STROBE LATE
58 - WRITE GATE
WRITING
3 - TXD
PST
CLKEN
WR
DSK/MEM
HEADER/DATA
EOB
DSK.WAIT
EOB
SH-1
CLOCK
Ø
NOT USED
OGB
NOT USED
+SR
NOT USED
INDEX
TP2
NOT USED
PLO CLK

MATERIAL: SEE SHEET 1	SCALE: NONE	IMI INTERNATIONAL MEMORIES INCORPORATED	
FINISH:	DRAWN: MIKA'ELE 12-17-80	PHASE 1 CONTROLLER LOGIC	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES: DECIMAL .XX ± .XXX ± FRACTIONAL ± ANGULAR ±	CHKD: RZB 6/11/81 APPROVED:	D	263-01528.001 BB
		SHEET 3 OF 4	REV.

IN-LINE REORDER NO 1129

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REV	DATE	EC NO.	REV	DATE	EC NO.
BB		270			

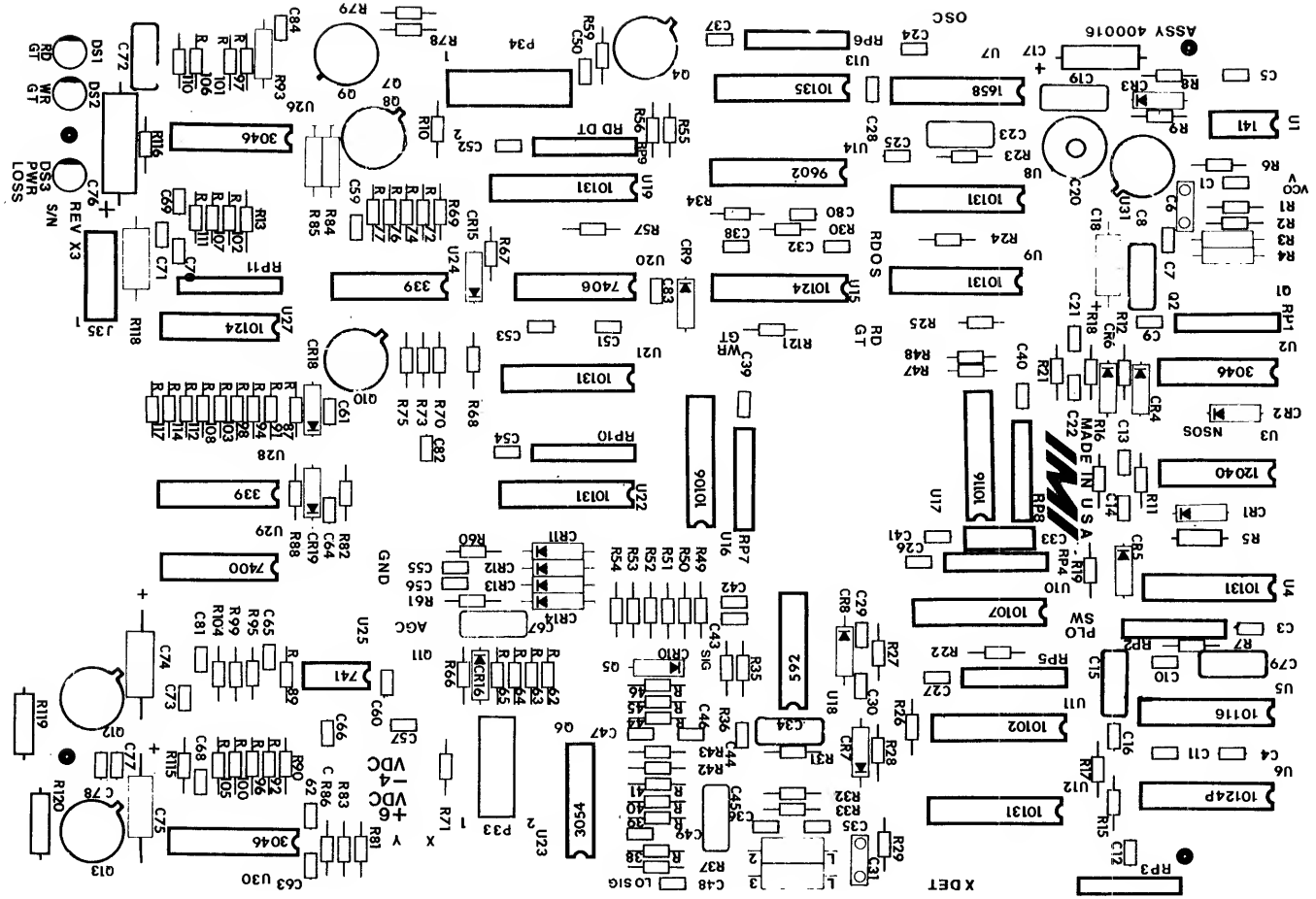
263-01528-001

NEXT ASSEMBLY | USED ON: 5007

DATA BIT BUS
RAM BUS
STROBE
LS132 2A/B
R31 620
C19 120pf
LS374 6A
LS373 6B
330
390
RP6 330/390 CUSTOMER OPTION ONLY
+5V
BEGRDY
S74 4D
XFERSTB
+5R
INTERRUPT
RESET
CR2 5082-2835
LS08 1B
LS279 4A INPUT XFR MODE
LS279 4A OUTPUT XFR MODE
LS279 4A XFR IN PROGRESS
LS74 3A
LS74 5A
LS74 5A
LS74 6K
LS00 5B
LS32 4C
LS32 4C
LS08 6E
9B 07
R27 1K
93 RDY
WR EXT/MEM
XFEREND
HSXSTB
HSX→MEM
HSXCLR
MEM→HSX
HSXFER
PIO RDY
LS32 7A
EXT WAIT
LS11 4B
RP1, 1K
Y4
Y3/5
R3 4.7K
LS04 4E
LS156
RAM DISABLE
TP6
A10
A12
ADDRESS BUS
LS08 1B
XFERBYTE
DISK→MEM
XMD
MEM→DISK
RAM BUS ENBL
RESET
LS32 4K
LS164 9E
R1, 1K
CR1 IN4148
C1 2.2μf
RP5 4.7K
-PWR LOSS
-SYS. RST. 89
LS04 9F
LS08 1B
LS04 9H
LS74 6K
M1
PWR
MREQ
WR
RD
SYSTEM CONTROL BUS
SYSTEM CONTROL BUS
NOT USED
69
70
71
88
74
76
ALTERNATE POWER "A" 87
ALTERNATE POWER "B" 117 118
ALTERNATE POWER "C" 88

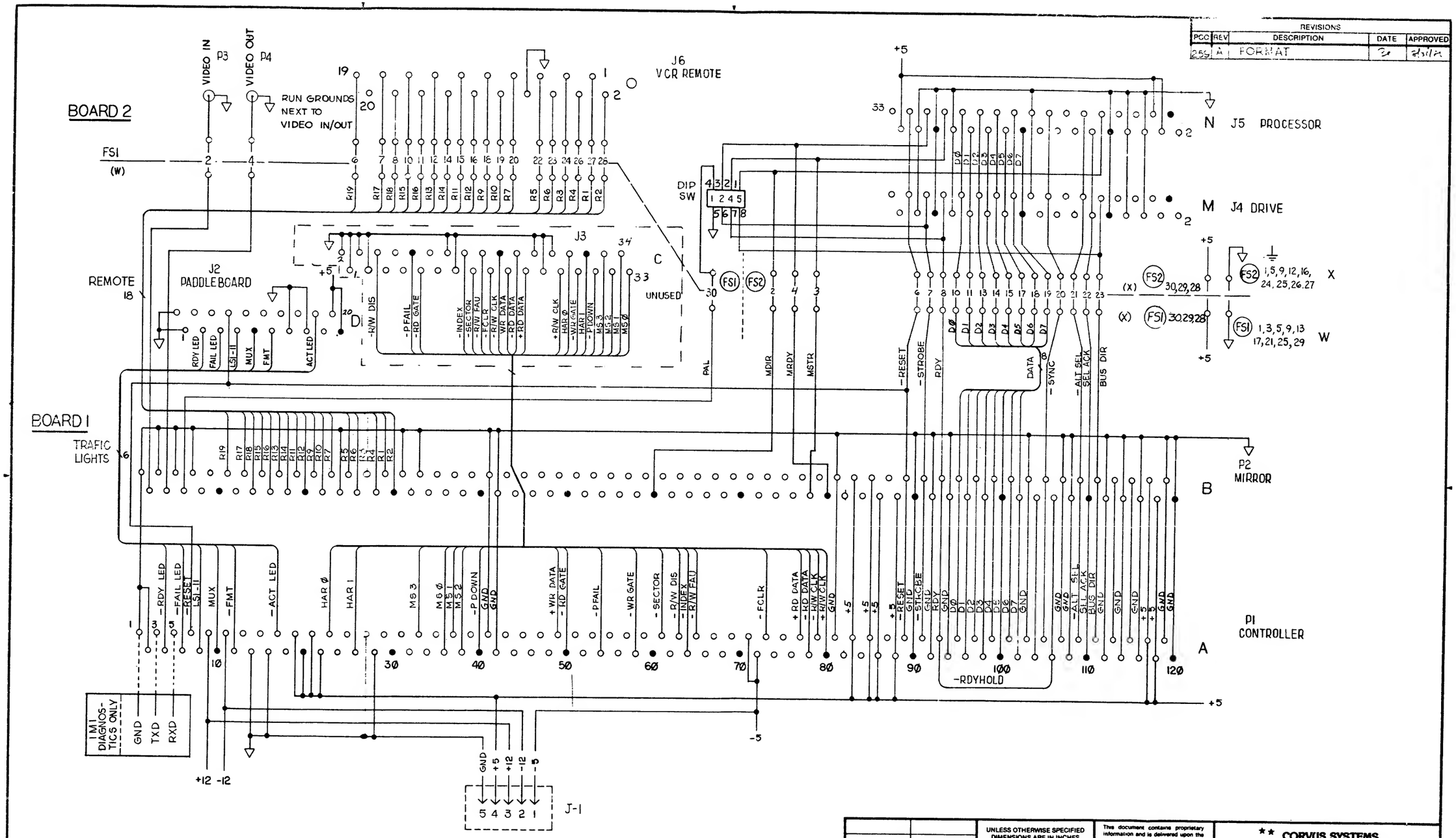
SEE SHEET 1	NONE	IMI INTERNATIONAL MEMORIES, INCORPORATED	
	MIKA'ELE 12-19-80	PCB SCHEMATIC, CONTROLLER/LOGIC	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCHES TOLERANCES: DECIMAL .XX ± .XXX ± FRACTIONAL ± ANGULAR ±	BB 6/1/81	D 263-01528-001 BB	
		SHEET 4 OF 4	REV.

D-LINE REORDER NO 1120


ASSY 400016
OSC
MADE IN USA
PLO SW
X DET
RD GT
WR GT
RDOS
AGC
SIG
GND
LO SIG
+6 VDC
+4 VDC
REV X3
S/N
PWR LOSS
NSOS
VCO

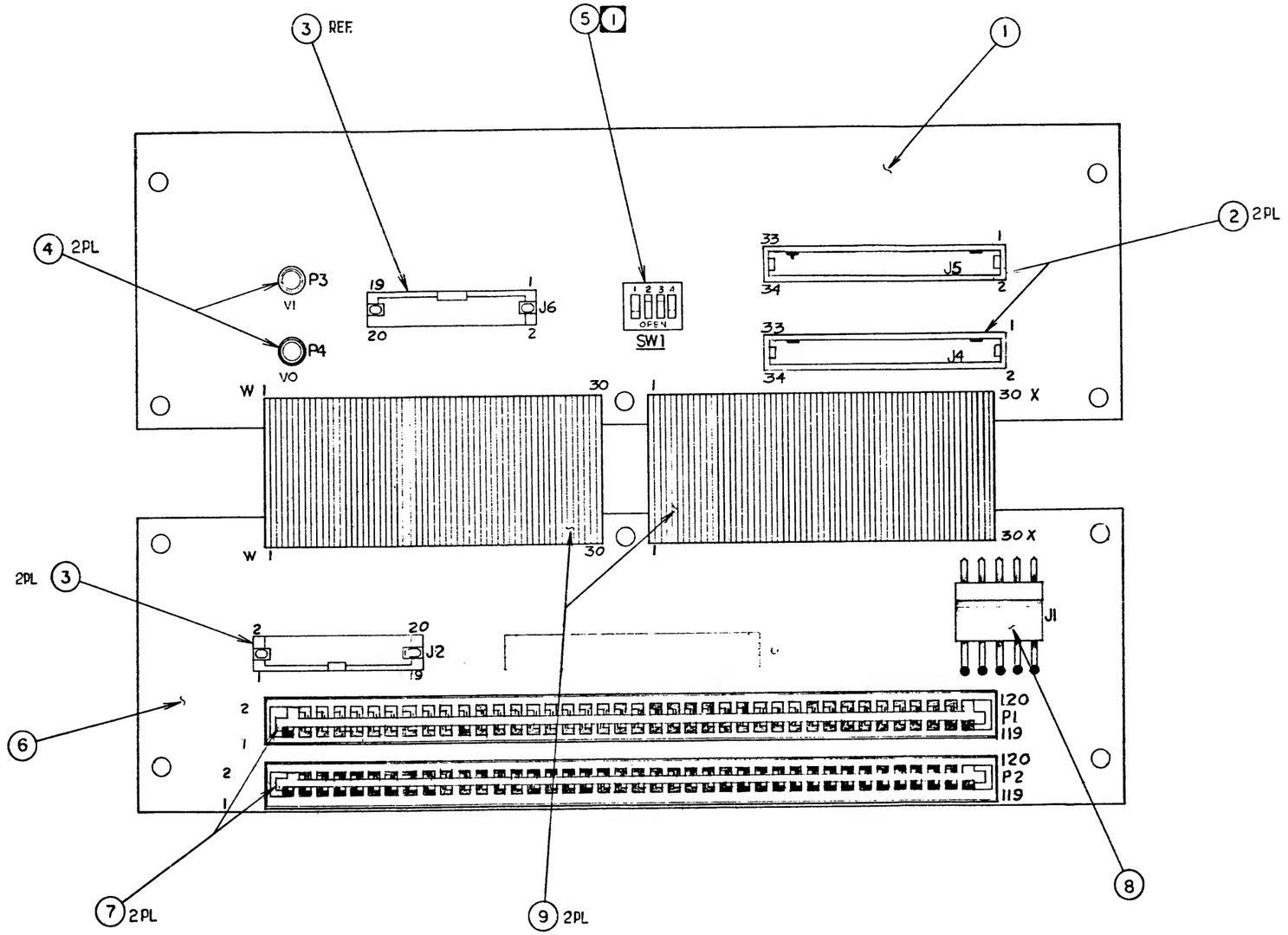
400018

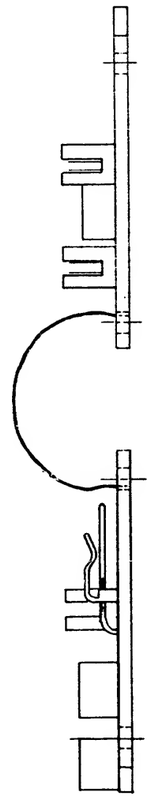
REVISIONS				
PCC	REV	DESCRIPTION	DATE	APPROVED
255	A	FORMAT	3-	2/81



NEXT ASSY	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON ANGLES ± DECIMALS .XX ±. .XXX ±.	This document contains proprietary information and is delivered upon the expressed condition that it will not be used directly or indirectly in any way detrimental to the interest of CORVUS SYSTEMS.	★★ CORVUS SYSTEMS ★ 2029 O'Toole Avenue, San Jose, CA 95131
APPLICATION		MATERIAL / FINISH	DRAWN BY HUY B. / DATE OF DRAWING 8-27-81 / CHECKED BY / ENGINEER / APPROVED / APPROVED	BACKPLANE ONE + TWO
				SCHEMATIC DWG. 1720-1791
				SCALE —— —— SHEET 1 OF 1

REVISIONS				
PCO	REV	DESCRIPTION	DATE	APPROVED
27	A	REL. FOR PROD.	-	-
325	B	REMOVE NOTCHES	2-26-82	[illegible]
380	C	DIP SW CHG-CORRECTION	4.14.82	[illegible]
669	D	CHG ITEM 2, ADD ITEM 10	10-1-82	[illegible]





1 INSERT DIP SWITCH AS A SECONDARY OPERATION. (AFTER WAVE SOLDERING)

8056	TOP CVR.
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
ANGLES ± DECIMALS .XX ±. .XXX ±.
MATERIAL
FINISH

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DRAWN BY HUY B. DATE OF DRAWING 12-4-81
CHECKED
ENGINEER L. FROHMAN
APPROVED E. Kraut 12/8/81
APPROVED

CORVUS SYSTEMS
2029 O'Toole Avenue, San Jose, CA 95131

P.C.A. 6MB BACKPLANE ASSEMBLY 6MB FOAM

ASSY DWG 8010-08108

SCALE 2:1 SHEET 1 OF 1